THE

Practical Teacher

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'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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Hygiene.

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Syphilis.—This is the most serious taint which can be transmitted from parent to child; there can be no doubt as to its effects. The actual mortality which figures in the Registrar-General's tables may be small, but the family physician is fully aware that they do not disclose the ravages which this scourge produces among the most helpless of the human race. Deformities, defective development, diseases of skin, blindness, idiotcy, imbecility, inanition, with many other serious deficiencies, often have their first cause in the tainted parent.

Scrofula and some of the secondary forms of syphilis are so similar that they have been classed together by some authors, and it is probable that there is an alliance between the two conditions. The frequent miscarriages, the weakly offspring which syphilitic mothers bring into the world, die in early life, and do much to diminish the incidence of the mischief. Nature does her best to counteract the plague by abortions and defective nutrition; but many infected children grow up to puberty, and propagate a further supply of ill-nourished, mis-shapen, and deformed individuals, with tumid lips, high cheek-bones, jagged, irregular, and defective teeth. These results are referred most generally to the scrofulous type, but in the first instance their parents, especially the father, were tainted in some cases by the syphilitic poison. It is to be hoped that the spread of hygienic knowledge will help to diminish still further the effects of a disease that is most horrible. The consequences cannot be made too widely known, so that young men may be warned in time of the dangers which beset the path of immorality.

There are many other diseases and degenerations which are capable of transmission, such as the irregularities that are seen to belong to certain families. The space at my command does not even allow me to enumerate them in detail. The consequences of taint are promoted by the intermarriage of relations, and diminished by a contrary habit. In concluding this important section of our subject, I would urge upon all hygienic students to strive by every means to diminish the evils consequent upon manifest taint, by discouraging the marriage of such as are so, and diminish the supply of delicate people in the world.

Prevention of Disease.—This part of our subject divides itself into several heads. It has long been recognised that the so-called enthetic diseases, such as Typhus Fever, Enteric or Typhoid Fever, Relapsing Fever, Intermittent Fevers, and some other forms of epidemic and infectious diseases, such as Cholera and Choleraic Diarrhœa, are distinctly preventable by the adoption of proper hygienic means, but it is only within recent years that some others such, as Consumption, Rickets, Acute Rheumatism, Epidemic Pneumonia; etc., etc., have been shown to be capable of being diminished by sanitary work. The direction which preventive measures should take will be, naturally, according to the nature of the disease itself: we will consider them, therefore, under three heads.

1. Those to be directed against infectious diseases.
2. Those which are required to control endemic diseases, such as Agues, Dysentery, Typhoid Fever, and Cholera.
3. Those which may be classed as constitutional maladies, in which we have Acute Rheumatism, Consumption, Rickets, Scurvy, etc.

Class 1. *Infectious Diseases.*—This class includes Small-pox, Chicken-pox, Whooping-cough, Mumps, Scarlet Fever, Diphtheria, Measles, Typhus Fever, Malignant Pustule, some forms of Erysipelas, Relapsing Fever, and Influenza.

Small-pox requires especial consideration. It could be completely eradicated if vaccination could be universally carried out. The action of the one disease counteracts and prevents the effects of the other, so that a person who has had the one does not usually take on the other when exposed to its influence. One attack of Small-pox (and, in a lesser degree, in nearly all the class of infectious diseases) diminishes the liability to a second attack. It will not exempt an individual for the rest of his life from the possibility of a second attack; one of the worst cases of Confluent Small-pox that I ever witnessed, occurred on a gentleman who had been badly marked by the disease, in his youth. Those who can carry their recollection back for some sixty years will remember the scarred faces and damaged sight which were then so

BRITISH MUSEUM

common from the effects of Small-pox; such conditions are all but unknown now. Those who have been properly vaccinated need not fear infection. The effect of the vaccine disease is to protect against the severer malady with the greatest certainty, provided the virus has been taken from a satisfactory case: but vaccination will not completely protect the individual any more than Small-pox itself. Unfortunately a strong prejudice has been raised against the operation of vaccination, because certain politicians saw in its compulsory application a departure from the principle of freedom, and an interference with the liberty of the subject, which was objectionable to their sense of justice. It happens also that occasionally a careless performance of the operation by dirty men produced evils which were and are still thought by the political agents to be necessary adjuncts to the action of the virus. Much feeling has been raised against vaccination among the ignorant poor, and also among those who see an opportunity of showing themselves as protectors of the people's rights. The injudicious action of Boards of Guardians and vaccination officers in prosecuting the dissenting parties, in some instances by sending them repeatedly to prison for disobeying the law, has fed the flame and raised a strong opposition against the compulsory clauses of the Vaccination Act. The careful inquiries of the Local Government Board, the earnest action of the major portion of the medical profession, and statistics furnished by our Small-pox hospitals, show very conclusively the falsity of the arguments which are used against vaccination. A medical man who should by his carelessness produce constitutional mischief in any child would be liable to heavy damages at law. Coincident with this is the fact that, although there are thousands of persons all over the country anxious to pounce upon such a case, they are yet unable to find one. This must be a conclusive proof of the falsity of the charges brought against the vaccine disease. The "*Post hoc, ergo propter hoc*" theory is so constantly affirmed by people who know not the facts, that an immense number of persons believe in the truth of the charges made. If similar charges were made against the families from whence Measles or Whooping-cough had been caught, because eruptions and abscesses frequently follow upon those complaints—viz., that the secondary complaints were due to the source of infection—the absurdity of the charges made against vaccination would be self-evident. Children who have been vaccinated are very liable to take cold about the time that the vesicle dies away. This danger is but too often forgotten; indeed, the law is, to some extent, responsible for the result, for it compels the exposure of the child at the vaccination station on the eighth day, no matter what kind of weather it may be. Some children take cold, and as a consequence they have eruptions, and sometimes abscesses, if the constitution of the child is tainted in the smallest degree with tubercular, scrofulous, or syphilitic taint; whilst if there is any tendency in the child's system to any of those skin maladies which are common among children born of gouty or rheumatic parents, there is a chance that such may appear some time before they otherwise would have done, if a chill be brought about as the vaccine disease is subsiding. I have repeatedly saved my credit by observing the tendency to skin eruption in a child brought for vaccination, and have deferred the operation to a more convenient season. The eruption has made its appearance, and fortunately for my credit, the child had not been vaccinated. Parents do not like to think that their own constitutions are at fault, and are glad of the opportunity of throwing the blame upon the doctor for using impure lymph. The syphilitic and strumous child is born with the taint. The promoters of the anti-vaccination party refuse to look at this aspect of the case, and in consequence are but too frequently making false charges against members of the profession, which they are utterly unable to substantiate. It is the bounden duty of the parent who loves his own child to have it vaccinated before it is six months old. The law says three. I would prefer a greater latitude unless it be performed within the month, which would in most cases be the safest plan. When a child grows up it should be re-vaccinated at eighteen. It is not necessary to repeat the operation after that, unless there be Small-pox in the house, or in close proximity, when it would be right to re-vaccinate all who have been exposed to the possibility of infection, and who have not been operated on for at least ten years.

A case of Small-pox should be immediately isolated, either by removal to infectious wards, which every Local Authority should have at their disposal, in a properly-constructed ambulance, or else all who have been exposed to the chance of infection should be removed from the premises, and placed in quarantine for about fifteen days, unless they agree to be re-vaccinated at once, the case being left *in situ*. The clothes and bedding should be disinfected by heat, or if of small value, burnt up.

It is asserted that sanitation will be sufficient to prevent the incidence of Small-pox, and that vaccination is unnecessary. This may be true in the distant future, when constitutions have been purified from their own inherent weaknesses, but that it will not be sufficient is shown in many ways. Vaccination, however, will protect against Small-pox, as is shown in Ireland, where the operation is all but universal. Small-pox is almost unknown in that island, whilst Typhus Fever is common. On the other hand, Typhus has been all but banished from London by sanitary regulation, but as there are numbers of unvaccinated people the disease persists. Vaccination with isolation are the proper remedies, each in its own direction, until the former is universal. *Chicken-pox* is not a fatal disease, and does not require the same careful precautions as Small-pox, but isolation is necessary. *Whooping-cough* is most difficult to keep out, as it is probably transmitted by aerial means. *Mumps* is in the same category. *Scarlet Fever* is much less transmissible by infection than is commonly supposed, but the same rules should be observed as are recommended in Small-pox; and, indeed, in all cases of infectious diseases it is requisite to observe a kind of quarantine with those who have been exposed to infection, as well as by isolating the patient, to prevent extension from the original centre. I shall best indicate the course to be observed by inserting the rules which have been adopted, in the district of Croydon, for the prevention of infection among pupils attending day-schools, which have been drawn up by the Medical Officer of Health, and distributed by the Urban Sanitary Authority. They may be headed as "Suggestions for the Prevention of Infection among Pupils attending Day Schools."

1. A pupil suffering from Measles, Scarlet Fever (or

Scarlatina), Diphtheria, Mumps, Whooping-cough, Chicken-pox, and Small-pox, should not be allowed to attend school.

2. No pupil should be allowed to return to school on recovery from an attack of any of the above infectious diseases until after proper personal disinfection, and the elapse of the period of time specified below for each disease, dating from the commencement of the attack :—

Measles, three weeks; Scarlet Fever, six weeks, all peeling of the skin having completed; Diphtheria, two months; Mumps, three weeks; Chicken-pox, two weeks, all scabs having fallen off; Small-pox, six weeks, all scabs having disappeared. In Whooping-cough a definite time cannot be fixed, but a pupil should not be re-admitted until his return is certified as safe by the medical attendant.

If possible, a medical certificate as to the freedom of the pupil from infective power should be required in all cases.

3. Although not suffering themselves from infectious diseases, pupils living in a house in which any one is so suffering may yet convey it to schoolfellows; therefore such pupils should not be allowed to attend school. This rule may be relaxed, first, in the case of pupils having already had an attack of the same disease, who may be permitted to attend school, provided they are kept from all contact with the patient until his recovery and disinfection are complete; secondly, in the case of pupils not having had the disease, but who on appearance of the illness have been removed to an uninfected house, these may return to school after a fortnight's interval.

Pupils are frequently sent to school while suffering from an infectious disease which has been overlooked because it is in an early stage, or is in a mild form. Care is required to detect and exclude such cases. The teacher or director of the school should therefore give immediate personal attention to any pupil in the school who may appear ill, or complains of feeling unwell. Feverishness should lead one to suspect the presence of infectious disease, more especially when it is combined with a rash on the skin, or with sore throat, or with both; and if the teacher is in doubt, the clinical thermometer, which he ought to know how to use, would at once settle any doubt he may have upon the point. A rise of temperature above 99° should be evidence enough to justify the instant removal of the child.

Precautions against Cholera.—It is certain that Cholera is not likely to arise in this country unless cases are brought into it. They will come, if at all, by sea. Individuals may bring the germs in their persons, and not suffer from the disease until after they have left the ship; or they may be so slight as to avoid detection at the port of landing. These cases, however, will not cause much mischief if the knowledge of their presence is notified at once to the Local Authority, and if they are dealt with immediately. It will only spread among the people when local conditions are such as assist to disseminate the virus. All matters which the patient discharges from his stomach and bowels are infective. It is important, therefore, that these should be destroyed. Under ordinary circumstances the patient will not infect other persons, any more than an adder can injure if it does not bite. When the disease appears, therefore, it will not spread unless there are certain facilities, such as the contamination of water supply by discharges from the patient. Cesspools, drains, and sewers so contaminated must be rigorously disinfected. Bedding, clothing, towels, water which has been used for washing the patient or cleaning his linen, or the place in which he has been lying sick, may spread the disease. Slops and wash-water, therefore, are most dangerous, and must be thoroughly disinfected. Every effort must be made to prevent the contamination of any source of water supply, and also to prevent the spreading of impure air from contaminated sewage. There may be danger in breathing air which is foul with such impurities. Miasmatic influences seem to prevail in Cholera-infected localities. House-refuse, and other refuse which has accumulated in proximity to a case must be immediately dealt with; such accumulations should be always prevented. It would be wise if all port authorities at which Cholera has appeared, would give notice to the Local Authority of any place to which a passenger by such ships has travelled. Each person should be watched, not impeded in his progress, for at least ten days after landing from a Cholera-infected place.

(To be continued.)

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How I Teach Domestic Economy.

BY MRS. WIGLEY,

Author of 'Marshfield Maidens,' 'Our Home Work,' 'Workers at Home,' 'Royal Series Domestic Economy,' 'Cookery and Home Comforts,' 'The Merryweathers,' 'Thoughts,' etc.

CHAPTER XI.

WHAT MAKES BONES, ETC?

AND now, if our teaching has been successful, there will very naturally arise in our children's minds the questions to which all our lessons have been leading up. They will be ready to ask, 'What are the different materials found in the various parts of our bodies, and where are we to seek for some of the same kind to keep up the necessary supply?' The answer to this question will bring us at once to our especial first year's course. 'Food, its constituents and nutritive value.' Our next step must be to take notice of the various things found in different parts of the body, and to show the foods which will supply those things.

We must again draw the children's attention to the body itself, and get them to name these parts. There is bone, blood, flesh, nerves, nails, and hair, etc.; each part quite different to the others and having a different work or office. Then we must examine these parts separately.

We will begin with the bones.

Of course you and I may be happy in the knowledge that our bones are composed of an animal and a mineral substance—that carbonate and phosphate of lime are in their construction, held together by fibres of gelatinous tissue. We may also further know that a carbonate has something to do with carbon, a phosphate with phosphorus, a sulphate with sulphur, and so on. But we cannot see our way to making our children partners in this knowledge now, because we have to confine ourselves to one subject, and to give only just such information as is absolutely necessary.

How much information *is* necessary here then? Our children must know that lime constitutes the principal part of our bones. They already understand that bones must be hard and firm, but unless we explain to them something of the way in which such bones are constructed they will not be satisfied. For if they have been *going with you* in the lessons, meeting your teaching with that sympathy of thought which all good teachers have the power of calling forth, they will know there must be some way by which the blood is able to traverse, and so to carry nourishment to the bones as well as to every other part of the body.

So we must briefly lead them to understand the porous condition of bone; how that it is generally hollow in the centre, and is intersected with numerous channels through it and around it, and encased in a soft coat; and how that every part of it is bound together by a perfect network of connective tissue, which is composed of gelatine, which holds the earthy particles together, and binds them into shape just as hair holds mortar.

And we shall find no difficulty in making this structure of the bones plain to our children. We can scarcely take up any school physiology but we shall find the subject illustrated in words something like the following:—

The bodies of almost all animals consist of hard and soft parts. The hard or bony parts we call *the skeleton*. The skeleton may be inside and surrounded by the flesh, as in man and many other animals, or it may be outside encasing the flesh, as in crabs and lobsters, insects and shell fish. All skeletons, whether external or internal, are largely composed of lime. When chemists wish to find out of what anything is composed, they try to take it to pieces; and if they cannot do this without, they destroy one part after another and see what remains.

We do the same thing for other reasons very often. We may have an article composed of iron and wood; well, the wood wears out first, but the iron is as good as ever. If we want to use the iron over again, we should put the whole into the fire. Then the wood would burn away and the iron remain in the fire, and we could remove it at our pleasure. Chemists have many ways of removing one thing without doing any harm to the parts with which that thing may be mixed. They can apply great heat or strong acid and test and dissolve until they are quite sure they have found out what they wish to know.

They know there is lime in bone. They also know that certain acids dissolve the lime. So they put a bone in some of this acid for a day or two and leave it. When the right time comes they pour off the acid, and they find a something left just in the shape of the bone still, but soft, and flexible, and elastic. You could pick it up and bend it and tie it in a knot if you wished to do so: and you could stretch it a little, and it would go back to its whole shape. This substance is the connective tissue, composed of gelatine, which holds the lime together.

But if the chemist puts this tissue into water, and lets it boil for a long time, it will gradually dissolve away in the boiling, and when the water is cold it will set like jelly. We know we often boil bones down to make jelly for soup. The jelly that comes out of bones is really the dissolved gelatine which forms the connective tissue.

And the chemist likes to know what the lime would be like if he removes the gelatine only; so he puts the bones into a vessel, with a tight-fitting lid, and then bakes them in a furnace. When he opens the lid of the vessel he finds the bone black, like charcoal, but all the gelatine has burned away. But sometimes he puts the bone in the open fire, then it burns until it is quite white, like chalk, and all the gelatine is consumed; but the lime does not hold together when this has happened, it powders and crumbles away—ever such a little knock breaks it up. The white powder is mainly phosphate of lime.

If bones were all gelatine they would not be firm or strong; if they were all lime they would not be tough, but brittle and easily broken.

To keep bones healthy we must have food which will contain lime, and food which will make gelatine, or else when the blood goes round bearing nourishment and material to do the necessary repairs, the bones would not find anything they needed, and so they would get diseased or weak, and would pine or waste away for want of material to supply their daily waste.

And next we must impart some little information respecting at least the flesh and blood.

Children are used to consider themselves such very solid and respectable little bodies that at first they will receive the notion that we are almost all water with some astonishment; but by degrees they will grasp the following ideas:—

If we put a joint of meat weighing eight pounds into a slow oven, and keep it there until all the moisture is dried out of it, we shall find that the solid part that is left will not weigh two pounds. More than three-quarters of all flesh is nothing but water.

A grown man sometimes weighs 154 pounds or eleven stone. If all the moisture could be taken from his body, such moisture would weigh 111 pounds, and there would only be forty-three pounds left to make up flesh and bones, etc.

Our flesh consists mostly of water, fibrin, and a little fat.

Fibrin is made up of a good many other things, but we find it ready mixed in more than one kind of food.

And then there is the blood.

We are not so surprised to hear that there is a great deal of water in the blood, because we are apt to think of it as a red liquid. But we must not forget the use of blood. It has to bear all the nourishment to every part of the body, so it must contain a great many different things. And it does so. More than twenty solid things are found dissolved or powdered up very, very small in the blood.

We can understand how necessary it is that the blood shall be all right. If we put into it too much of one thing or too little of another, it will be all wrong; then we say the blood is in a bad state, and we get ill. If nothing wrong ever got into the blood, and if nothing right for it was ever kept out of it, then we should always be well.

The principal solid matters found in the blood are Fibrin, Albumen, and Gluten. And there are chemical salts, such as common salt and potash; and small quantities of some metals, such as iron and copper.

Dr. Lankester says, 'A body weighing 154 pounds may be thus divided:—

Water ...	...	111 lbs.
Gelatine...	...	15 ,,
Albumen	...	4½ ,,
Fibrin ...	...	4½ ,,
Fat ...	...	12 ,,
Other compounds		7 ,,
		154 lbs.

But though these other compounds make up only a small weight we cannot do without one of them, the very smallest has something to do in the body which nothing else can do, and must therefore be taken in our food if we are to be kept in health.

(*To be continued.*)

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Popular Mythology.

BY THE REV. SIR GEORGE W. COX, BART., M.A.,
Author of 'Tales of Ancient Greece,' 'Mythology of the Aryan Nations,' etc.

[These papers are designed for our youngest readers. Used as themes for composition work, they will be found invaluable.]

III.

Aisa.—A Greek name for the being who executes the will of Zeus, and who thus answers closely to the idea of Destiny or Fate. Aisa means, indeed, strictly the spoken word; and this is also the meaning of the Latin Fatum. Aisa, as a minister of the Supreme Deity, belongs to the large group which includes the Greek Moirai and Eumenides, the Latin Parcæ, the Teutonic Norns, and others, which will be noticed in their order.

Ajax [Aias].

AIAS, in its Latin form Ajax, was the son of Telamon, and one of the heroes who fought on the Achaian side in the Trojan war. In the Iliad we hear of little more than his enormous strength and the marvellous feats which he was thus enabled to accomplish. In the Odyssey we are told that he became a competitor for the arms of Achilleus, after the death of that hero, and that his defeat in this contest led to his own death. On this hint, perhaps, was built up the story which Sophokles has made so impressive in his beautiful tragedy. According to this story, the success of Odysseus, to whom the arms were adjudged, drove Aias mad from grief and shame, and impelled him in his frenzy to fall upon the cattle of the Achaian army, thinking that they were actually the men who had done him wrong. Under the conviction that he had tortured and slain Odysseus, Aias was for a time in a state of feverish joy; but when his eyes were opened to the true facts, the revelation plunged him in despair, and he fell upon his sword, the fatal gift of Hektor, to whom the gift of Aias in exchange for it was not less fatal. Aias had given him his girdle, and with this girdle Achilleus, as the story goes, tied the body of Hektor to his chariot wheels and dragged it round the walls of Troy.

Akrisios, king of Argos, is one of the vast number of sovereigns, chiefs, or rulers, whose destiny is to be slain by their children or their grandchildren. In almost all these instances they are terrified by an oracle or prophecy which warns them of the danger; but although in each case they expose the child, or cast forth its mother in a chest upon the raging sea, or give the babe in charge to servants who are bidden to slay it, the child invariably survives, and after spending its youth among those who know nothing of his high lineage, wins himself a name for heroic bravery as well as for surpassing bodily beauty. In the end the prophecy is fulfilled, sometimes by a mere accident, and sometimes in revenge for a wrong committed by the parent, who does not know that the person whom he is injuring is his son. Akrisios is the father of Danaê, whom he shuts up in an inaccessible tower, because he has been warned that his son will be his destroyer. But his precautions are vain. Zeus enters her dreary prison in the form of a golden shower, and Danaê becomes the mother of the great Argive hero Perseus, whose story we shall tell hereafter.

ALCESTIS (ALKESTIS).

ALCINOUS (ALKINOOS).

Alexandros, in the Iliad, is a name of the Trojan hero Paris, given to him, we are told, because he was the friend and helper of men. But the word may be not less accurately taken to denote one who scares or drives men away; and this meaning is more in accordance with the general character of Paris, who brings misery and ruin wherever he goes.

Alkestis (Alcestis), the beautiful daughter of Pelias, became the wife of Admetos, the chieftain of Pherai, a town in Thessaly. At her marriage feast the libations of wine were duly offered to all the other deities; but the name of Artemis was forgotten, and the wrath of the virgin goddess sealed the doom of all who offended her. Nothing could have saved Admetos, had not Phœbus Apollo, the brother of Artemis, been at the time a bondman in his house. This was the punishment to which Apollo had been sentenced for slaying the Kyklôpes (Cyclopes), or giants who had smitten down his son Asklepios (Æsculapius), at the bidding of Zeus. In Admetos the mighty sun-god found a kindly master, and in his gratitude he promised that if his sister should send on him a fatal sickness he should not die if he could find one who in his stead would go down into the dark kingdom of Hades.

The sickness came, and the strength of Admetos dwindled away, for neither his father nor his mother would sacrifice for him the little span of life which old age might still have left for them. But when Alkestis learnt that the devotion of another might save her husband, her love made her instantly ready to offer herself. The disease which was poisoning the blood of Admetos was transferred to her own. Hastening to her chamber, she found a nest of vipers in her bridal bed, and lay down calmly to die.

The heart of Admetos was filled with grief and shame; and the anguish which oppressed him was in strange contrast with the sounds of feasting and revelry which were filling his house. In the great hall of his palace a mighty guest was enjoying a splendid banquet, and this guest was none other than the mighty hero, who slew the Hydra of Lerna and the boar of Erymanthos, and who came out conqueror from every contest in which he was engaged. When Herakles learnt the reason which prevented Admetos from taking part in the feast, he declared that the dark powers should not keep Alkestis in their grasp. Hastening away he found Thanatos (or Death), who was bearing Alkestis to the land of shadows, and after a desperate struggle he beat him off. With her return to her home the light and gladness of the old days came back also.

This story of Alkestis corresponds, as we shall see in its essential features, with that of Iphigeneia; and the comparison will show us the true meaning and origin of the tale.

Alkinoös (Alcinous), is the king of the Phaiakians who dwelt in the land of Scheria. He is the father of the beautiful Nausikaa, and he befriends Odysseus, the man of many griefs and wanderings. But the marvels of his palace and his fleets will be noticed when we come to speak of the wonderful gardens of the Hesperides, the Hyperboreans, and the Phaiakians, and of the ships which move without oars, sails, tackling, masts, or rudders, and yet which are never wrecked and never fail to reach the haven which they are seeking. *(To be continued.)*

Science Notes.

M. PASTEUR seems really to have discovered a means of rendering animals proof against hydrophobia. He has experimented successfully upon dogs, and has also tested the value of his remedy upon one human subject. The person was inoculated with virus from a rabbit, and was at length proof against the strongest hydrophobia poison.

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PROFESSOR JOLLY has invented what he calls a meldometer, by which the melting points of minerals may be compared and their behaviour studied at high temperatures. It consists of a narrow ribbon of platinum, arranged so as to traverse the field of the microscope. The ribbon is attached to supports and clamped to wires leading to a battery. The strip can then be raised in temperature up to the melting point of platinum. The strip of platinum is placed on the stage of the microscope and brought into the field of a one-inch objective, which is protected by a glass slip from the radiant heat, and the observer is sheltered from the intense light at such a high temperature by a wedge of coloured glass. The behaviour of the substance can thus be watched as the temperature rises, and, if desirable, the effects of reagents upon it.

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TELPHERAGE.—The first telpher line erected in this country was opened on the 17th of October at Glynde, in Sussex. The idea of propelling a set of light trains along a single rail or rope was due to the late Professor Fleeming Jenkin. But to Professors Ayrton and Perry much of the success is due of working out the original plan. Telpherage has been defined as the transmission of goods and passengers by means of electricity, without driver, guard, signalman, or attendants. The line at Glynde is nearly a mile long and is used to convey clay from the clay-pits to the London, Brighton, and South Coast Railway. The speed of the train is about five miles an hour. The cost of carriage is considered very low. We may be sure that this is the beginning of a very important development in the facilities for the transmission of goods, and ultimately of passengers. Professor Perry is the engineer to the company which has started the first telpher line.

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GAS STOVES.—These are coming more and more into favour. We drew attention to the fact in a previous number. They are becoming popular, and deservedly so. But we are often asked if there is any smell with them. Some of our friends assure us that their stoves emit no smell. Perhaps they have wisely placed them in a scullery or under a chimney. If not we can only say it would be a good thing if they did smell. It must be confessed that the inventors of these stoves have, as yet, done very little in the way of carrying off the products of combustion. A stove is often fitted up in a kitchen without any connection at all with a draught. Even where the gas and fumes from the inside of it are carried into the chimney, far the greater quantity of spent gases, steam from boiling water, and other volatile matters from the cooking are carried into the kitchen, often to find their way all over the house from bottom to top. If the cooking utensils are clean, it is quite possible there will be little smell. There is little smell in rooms where gas is used for the purposes of light; but the air is nearly always bad and frequently positively injurious. Housekeepers understand that they pay for the gas which the company supplies at the rate of about 3s. per thousand cubic feet. It is worth while remembering that, speaking generally, every cubic foot yields, when burnt, two cubic feet of a most undesirable gas, besides a large amount of moisture. Some of our readers may like to apply a rough test to the air of a room. Buy a small bottle of lime-water, and ask the chemist to put it in a bottle with marks upon it, so that you can pour out half an ounce at a time. Now take a clean glass bottle that will hold ten-and-a-half ounces. wash it and dry it, and fill it with the air to be tested. It can be filled by blowing into it with a pair of common bellows, or by putting a tube into it and sucking the air out of it. Air must not be blown into it from the lungs. Now pour into it one half-ounce of the lime-water and well shake the bottle. There ought not to be any precipitate. If there is, the air is not good, if there is a considerable amount of precipitate the air is positively bad. It is interesting to perform the same experiment on the air from an open space, and on the air in the house in the daytime and at night. Of course it is only a rough test, but it is instructive.

***

THERE are some very eminent men who are quite dissatisfied with the results of the science teaching in primary schools and evening classes. It would appear that the results of the teaching in the middle and higher schools is equally unsatisfactory. If so, perhaps, there is something wrong in the system and (let us only whisper it) with the examiners themselves. The report of the work done at the late Higher Local Examination is before us. We find that 'there were fewer failures in Trigonometry and Algebra, but the work of the better men was not so good as it was last year. In Mechanics results were stated when they should have been proved. In the Elementary Natural Science Paper, the work was as a whole extremely poor, notably in chemistry. In Physics the candidates seemed to possess very little power of giving concise and definite answers. The attempts to describe experiments were remarkably weak, and might be described as a mere echo of experimental labours, only partially understood. They showed none of the results that might fairly be expected from a careful consideration of the facts and principles which were clearly within the candidates' reading. In Zoology most of the papers were far from creditable, and exhibited little of intelligent knowledge. The answers to the practical questions were uniformly bad.' These criticisms are not pleasant reading. Middle-class teachers will do well to study them. It may possibly be found that the syllabus and questions have been unsuitable, and certainly no man should examine boys who has not had experience in teaching them himself.

Notes of Lessons on Ocean Currents.

BY JOS. H. COWHAM, F.G.S.,
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MOVEMENTS OF WATER. No. II.

LESSON I.

INFORMATION.

1. Currents caused by Winds.

(*a*) Winds blowing across seas and oceans disturb their surfaces, and cause the formation of **Ripples, Waves,** and **Breakers.**

1. **Ripples** are formed by gentle breezes. They are most frequently seen upon the surface of small areas of water, such as **pools** and rivers.

2. **Waves** are caused by strong winds blowing across **seas** and **oceans.**

3. **Breakers** are formed when sea waves dash on a shore.

(*See previous lesson on Waves.*)

(*b*) If winds continue to blow in one direction, the surface water is impelled in the same direction. This forward, or onward movement of the water, is a **Drift Current.**

The great Equatorial Currents of the Atlantic and Pacific Oceans flow in the direction of the Trade Winds.

(*c*) At the same time currents are set up in an opposite direction to the Drift Currents in order to restore equilibrium. These are called **Counter Currents.**

2. Contrasts between Currents and Waves.

CURRENTS.	WAVES.
(*a*) The movement is onward. (*Translatory.*)	(*a*) The movement is up and forward, down and backward. (*Undulatory.*)
(*b*) Formed in the oceans over which constant and periodic winds blow, and they continue to flow in the same direction.	(*b*) Formed on the surface of all seas and oceans, and change in direction and size with the wind.
(*c*) Move slowly: — The Gulf Stream at Florida travels at the rate of 4 miles per hour.	(*c*) Move rapidly, sometimes 50 miles per hour:—The rate is greatest in wide and deep ocean basins.

3. Chief Wind or Drift Currents.

(*a*) *In the Atlantic.*—The Equatorial, the Gulf Stream, and the Guinea Currents; the Arctic, the Labrador, the Brazil, and the Connecting Currents.

(*b*) *In the Pacific.*—The Equatorial, Japan, Mexican, Australian, Antarctic, and Peruvian Currents.

ILLUSTRATIONS AND TEACHING HINTS.

Fig. 1.
1. Ripples. 2. Waves. 3. Breakers.

(*a*) Illustrate by the diagram (Fig. 1), and refer to the pupils' experience of similar movements on ponds and on the sea.

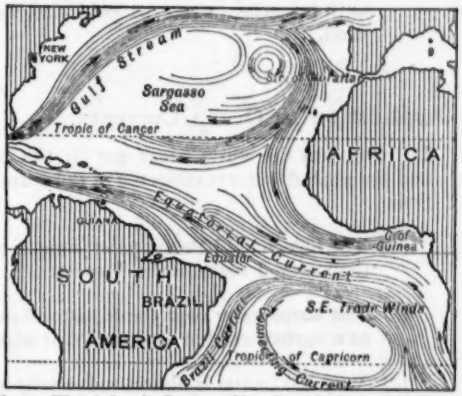


Fig. 2. The Atlantic Ocean: Showing (*b*) the connection between the constant Trade Winds and the Equatorial Current.

(*c*) Notice the deflection of the current to the north and south on approaching the American Coast, giving rise to the Gulf Stream on the *N.* and the Brazil Current on the S. Notice also the return or Counter Currents.

(*a*) Refer (1) To a boat on a tidal river. It moves along with the current, and rocks with the waves.
(2) To a sea-bird floating with the current and riding over the waves.

(*b*) See the sketch maps for the connection between winds and currents.

(*c*) State these facts, and express the different rates of movement in the form of a ratio 4 : 50.

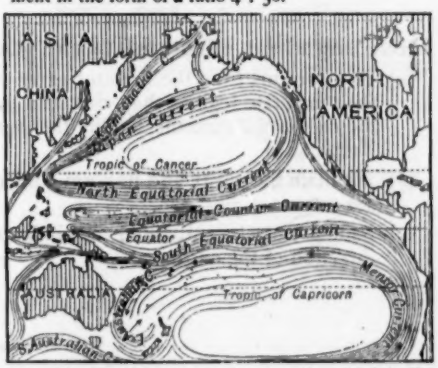


Fig. 3. The Pacific Ocean, showing the chief Drift and Counter Currents.

(*c*) *In the Indian Ocean.*—North of the Equator the currents are variable: south of the Equator are the Equatorial, the Mozambique, and the Counter Currents.

Teach the names by associating them with the position of each current named on the sketch-map. Direct special attention to the currents in the Pacific, which resemble, in position and general character, those in the Atlantic, *e.g.*, the Gulf Stream and the Japan Current. Both are warm currents flowing north-eastward from tropical to temperate climates.

LESSON II.

4. Currents caused by unequal temperatures.

FACTS FOR OBSERVATION.

(*a*) When water is heated it expands.

(*b*) Warm water is lighter, bulk for bulk, than cold water.

(*c*) The warmed and light water is forced out of place by the colder and heavy water.

(*d*) When water is chilled down to a temperature not exceeding 4°C. it sinks below the surface, until it reaches water as cold and heavy as itself.

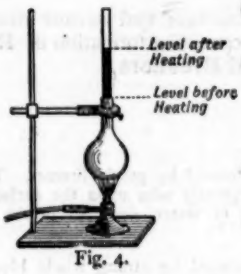


Fig. 4.

(*a*) By direct observation (Fig. 4) water is seen to expand.

(*b*) By inference, as the vessel contains less of the fluid after heating and expansion, the water in the vessel is lighter than before heating.

(*c*) Shown by experiment (Fig. 5).

(*d*) Shown by experiment (Fig. 6).

5. Application to Ocean Currents.

In the oceans the warm areas are in the Tropics, and the chilled water is collected in Polar and Arctic Seas.

(*a*) The heavy, cold Polar water moves towards the warmed water in the Tropics.

(*b*) The warm water near the Equator flows over, as a surface current towards Polar regions.

(*c*) Very cold water is almost universally found in the lower depths of the ocean.

For illustration of these truths try experiment Fig. 7.

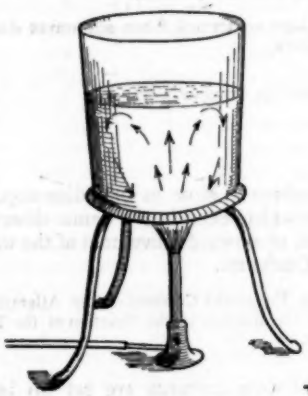


Fig. 5. Heat causing upward and downward currents.

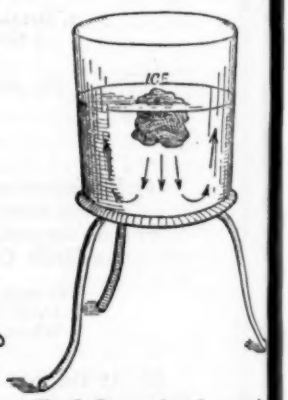


Fig. 6. Ice causing downward and upward currents.

Examples:—The late Dr. Carpenter held that the Gulf Stream was continued north-eastward, from about Lat. 40° N., by this oceanic circulation. The steady indraught of cold water from the Poles is supposed to be another example. The *Challenger* Expedition found the temperature of the Atlantic floor to be uniformly about 35° Fahr.

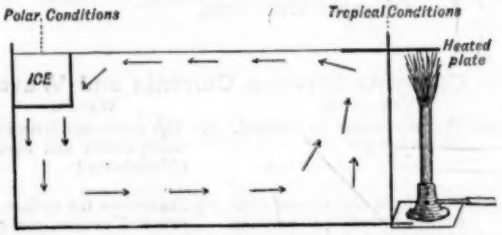


Fig. 7. Dr. Carpenter's Experiment, illustrating oceanic circulation.

6. Most important effects of Ocean Currents.

(*a*) The currents from the Equator carry warmth to the temperate regions they visit, and, *vice versa*, the cold Polar currents modify the heat of the Tropics.

(*b*) Maintain the purity and uniform composition of sea-water.

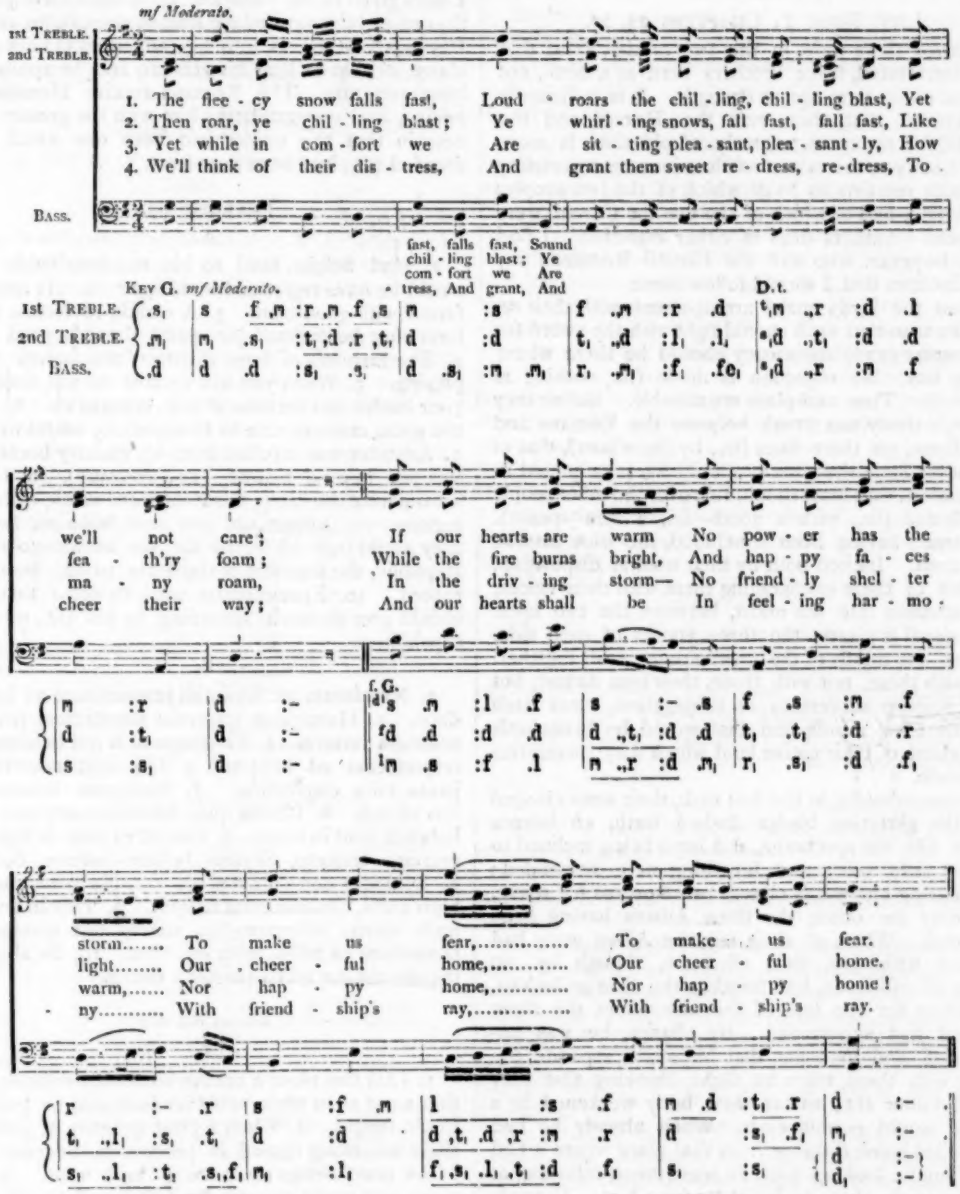
(*c*) Sailing vessels are aided or hindered by the direction of the currents.

(*a*) Impress this truth by referring to the climate of the following towns in the same latitude:—

Sitka	mean temperature	45°	Fahr.	(*Japan Current.*)
Nain	,, ,,	28°	,,	(*Arctic Current.*)
Edinburgh	,, ,,	47°	,,	(*Gulf Stream.*)

(*b*) Teach by referring to the fresh character of the sea water off the mouths of great rivers. By currents this is mixed with oceanic water.

(*c*) Vessels outward bound to Australia cross the Atlantic towards Rio in order to have a favourable current across the South Atlantic and Southern Oceans.

WINTER.

mf Moderato.
1st TREBLE.
2nd TREBLE.
BASS.
1. The flee - cy snow falls fast, Loud roars the chil - ling, chil - ling blast, Yet
2. Then roar, ye chil - ling blast; Ye whirl - ing snows, fall fast, fall fast, Like
3. Yet while in com - fort we Are sit - ting plea - sant, plea - sant - ly, How
4. We'll think of their dis - tress, And grant them sweet re - dress, re - dress, To
fast, falls fast, Sound
chil - ling blast; Ye
com - fort we Are
tress, And grant, And
KEY G. mf Moderato.
D.t.
we'll not care; If our hearts are warm No pow - er has the
fea - th'ry foam; While the fire burns bright, And hap - py fa - ces
ma - ny roam, In the driv - ing storm— No friend - ly shel - ter
cheer their way; And our hearts shall be In feel - ing har - mo -
f. G.
storm..... To make us fear,..... To make us fear.
light..... Our cheer - ful home,..... Our cheer - ful home.
warm,..... Nor hap - py home,..... Nor hap - py home!
- ny..... With friend - ship's ray,..... With friend - ship's ray.

Lessons in Latin.

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(*Continued from page* 439.)

KEY TO EXERCISES.

EXERCISE 66.

LIVY, BOOK I, CHAPTERS 24, 25.

By chance there were in the two armies, as at that time constituted, three brothers born at a birth, not unequal either as to age or strength. It is sufficiently well known that they were the Horatii and the Curiatii, for no event, scarcely, of old time is more celebrated; yet, in a matter so illustrious, an uncertainty of names remains as to of which of the two peoples the Horatii, and of which of the two the Curiatii were members. Authors draw in either direction. I find more, however, who call the Horatii Romans; my mind inclines that I should follow these.

When the kings make arrangements with their respective trios that each should fight with the sword for his country (and) supremacy should be there where victory was. No objection is made (lit., nothing is objected). Time and place are suitable. Before they fought, a treaty was struck between the Romans and the Albans, on these lines (lit., by these laws), that of whichever State the citizens should have conquered in that contest, that State should rule over the other people unmolested (lit., with a good—*i.e.*, a firm—peace). The treaty having been concluded, the trios assume their arms. Incited both by their natural disposition, and full of those encouraging them with their voices, they advance into the midst, between the two lines. The signal is given; the three youths of each side, bearing the minds of the great armies, rush together. Nor with these, nor with those, their own danger, but the common supremacy or subjugation, turns itself towards their minds, and that would be henceforth the fortune of their native land which they themselves had made.

As immediately, in the first rush, their arms clanged and the glittering blades flashed forth, an intense horror fills the spectators, and hope being inclined to neither side, voice and breathing were suspended; then having afterwards closed, two Romans fell dying, one over the other, the three Albans having been wounded. When, at their fall, the Alban army had shouted with joy, then all hope, though by no means all solicitude, had forsaken the Roman legions, breathless for the fate of the one whom the three Curiatii had surrounded. By chance, he was unwounded, and in order that he might separate the battle with them, takes to flight, thinking that they would follow (lit, so) as their body weakened by a wound would permit each. When already he had proceeded some distance from that place where it had been fought, looking back he sees (them) following at long intervals, that one is not far from him. Towards him he returned with a great rush, and whilst the Alban army shouts to the Curiatii to bear assistance to their brother, Horatius, having slain his enemy, was already, as a victor, seeking the second combat.

Then the Romans encourage their soldier, and he hastens to conclude the battle before the other, who was not far off, can come up, and he dispatches the second Curiatius; and now, Mars being equalised, (for) one on each side was surviving, but not equal either in hope or in strength. The one, a body untouched with the sword, and the double victory were bringing up eager for the third combat; the other, dragging a body wearied with a wound, wearied by running, and cowed by the slaughter of his brothers before his eyes, is opposed to a victorious enemy. And there was no battle. The exulting Roman says: 'Two of your brothers I have given to the "Shades," and a third I will give for the cause of this war, that the Roman may rule the Alban.' His sword he thrusts into his (adversary's) neck from above, ill able to bear his armour, and he spoils him lying prostrate. The Romans receive Horatius rejoicing, and congratulating him with the greater gladness in that the matter had been one which they dreaded (lit., had been near fear).

EXERCISE 67.

A.

1. Had Scipio lived to his one-hundredth year, would he have regretted his old age? 2. He obtained favour with good men. 3. A certain reverence, therefore, must be directed (*i.e.*, paid) towards good men. 4. The manners of boys discover themselves while playing. 5. When you will be able to sail, owing to your health and the time of year, come to us. 6. After the gods, men are able to be especially useful to men. 7. Aristides was expelled from his country because he was just beyond manner (*i.e.*, measure). 8. Caesar set out from the camp, about the third watch, with three legions. 9. Atticus did not seek honours, because they could not be borne for the advantage of the Republic, the manners of the State having been corrupted. 10. Epaminondas used to order that each should give so much, according to his (lit., of each) capabilities.

B.

1. Nuntiatum est Simonidi juvenes stare ad januam duos. 2. Haruspices jusserunt simulacrum Jovis ad orientem vertere. 3. Fit saepe ut ii qui debeant non respondeant ad tempus. 4. Uri sunt magnitudine paulo infra elephantos. 5. Statuerunt injurias per vos ulcisci. 6. Omnia quae secundum naturam fiunt habenda sunt in bonis. 7. Darius, ex Asia in Europam exercitu trajecto, Scythis bellum inferre decrevit. 8. Miltiades non dubitans sua consilia perventura ad regis aures, Chersonesum reliquit. 9. Hoc in tempore nulla civitas Atheniensibus auxilio fuit praeter Plataeensium, ea mille misit militum. 10. Is abest ab oppido circiter millia passuum decem.

EXERCISE 68.

A.

1. (At) this place a certain somewhat difficult question arose as to when new friends should be preferred to old (ones). 2. When a great quantity of gold and silver was being carried in procession, Socrates said, 'How many things there are I don't want.' 3. The spoils of a single commander put an end to (the payment of) tribute. 4. Prize-fighters, even when in the act of striking an antagonist, fetch a groan. 5. Wisdom wou'd not be coveted if it answered no end. 6. Granting that it is so, yet you are not able to affirm this. 7. I will go through the affairs of the Roman people, now hence free, in peace and war. 8. He put them on oath that they should suffer no one to rule at Rome. 9. He filled up the number of the fathers to

the sum of three hundred. 10. That was profitable for the harmony of the State.

B.

1. Suam quisque domum tum obtinebat. 2. Summos honores a populo Romano adeptus est. 3. Multae gentes nondum sciunt cur luna deficiat. 4. Quaero num aliter ac nunc eveniunt evenirent. 5. Ea recte spolia opima habentur quae dux duci detraxit. 6. Proditores et transfugas arboribus suspendunt. 7. Quum testes dabo ex Sicilia quem volet ille eligat. 8. Gaudeo salvum te advenire. 9. Constat ad salutem civium inventas esse leges. 10. Themistocles recessit Argos habitatum.

LESSON LXIX.

GENITIVE AND ABLATIVE OF DESCRIPTION AND OF PRICE.

553. A noun is often followed by another noun in the genitive or ablative (always qualified by an adjective) which denotes description—as, 'vir maximi corporis,' 'a man of great stature;' or 'vir mediocri ingenio,' 'a man of moderate ability.'

554. Price, when expressed by an adjective, is sometimes in the ablative—when 'pretio' is understood—but generally in the genitive; but the actual price, whether money or anything else, is put into the ablative—as 'Quanti docet?' 'For how much does he teach?' 'Victoria magno sanguine stetit,' 'The victory cost much blood.'

555. The following adjectives are followed by an ablative case, dignus, *worthy;* indignus, *unworthy;* contentus, *contented;* praeditus, *endowed;* fretus, *relying on;* and liber, *free*—as, 'vir viribus fretus,' *a man relying on his strength.*

556. VOCABULARY 69.

English.	*Latin.*	*Derivatives.*
Courtesy, tact	făcultas G. -tātis, f.g.	faculty
Liberality	lĭbĕrālĭtas G. -tātis, f.g.	
Old	priscus -ca -cum R. prisc	
Too (much)	nimis, adv.	
Severity	sĕvĕrĭtas G. -tātis, f.g.	
Commentary	commentārius, and -um., m. or n. g.	
Piece of silver	nummus, O. decl. G. Pl. nummŭm	
Barter	{compensatio mercium} G. -onis mercium (literally, a balancing of merchandise)	
To buy	{mercari, dep. A conj.} R. merc	merchant
Nothing	nihĭlum G. nihili, n.g.	annihilate
Price	prĕtium G. pretii	precious
Painter	pictor G. pictoris	
Picture	tabula G. tabulae	tabulate
To bid for	{licitari, dep. v. A conj.} R. licit	
Carthaginians	Poeni, O. decl., pl.	Punic
To cost	stāre P.R. stĕt	3rd R. stat (see 42)
Murderer	percussor G. percussōris	
Gift	dōnum G. doni, n.g.	donation
Polite	hūmānus -na -num R. human	
To sell	vendĕre P.P. vendĭd	3rd. R. vendĭt
Endued with	praeditus -ta -tum R. praedĭt, followed by ablative.	
Religion	rĕlĭgio G. -ōnis	
Authority	auctoritas G. -tātis	
To break (of day)	orīrī, dep., I conj.	orient
Ever	unquam	
Grandfather	āvus G. avi	
Also	ĕtiam, conj.	
Soul	ănima for animus G. animae (see Voc. 28)	
As, a coin	as G. assis, m.g.	{originally a pound of uncoined copper}

557. EXERCISE 69.

A.

1. Titus fuit (38) facultatis tantae (63) et liberalitatis, ut nemini (17) quidquam negaret (53). 2. Vir (18) priscae ac nimis durae (61) severitatis est. 3. Plinius commentarios suos (20) vendere (10) poterat quadringentis (44) millibus (44) nummum. 4. Lycurgus emi (28) singula (66) non pecunia (45) sed (6) compensatione mercium jussit (29). 5. Mercatur tres (44) libros (6) nihilo minore (49) pretio quam (48) quod (27) erat (38) petitum (65) pro (28) omnibus (29). 6. Aristidis Thebani (Eng. of Thebes, or the Theban) pictoris unam (31) tabulam (41) centum talentis (44) rex (8) Attalus licitatus est. 7. Themistocles persuasit (16) populo (16) ut classis (60) centum (44) navium (9) aedificaretur (60). 8. Sapiens (49) dolorem (39) nihili facit (43). 9. Multo (20) sanguine (35) ac vulneribus (40) ea (37) Poenis victoria (37) stetit. 10. Darius mille (44) talentis (44) percussorem Alexandri emere (28) voluit (53).

B.

1. Tarquin had a brother (14), a youth (41) of a gentle (30) disposition (66). 2. Cyrus the Less (49), when (13) Lysander, a man (18) of the highest (64) valour (26), came (19) to (10) him (37) at Sardis, and brought (52) gifts to him (37) from (67) the allies (33), was (38) courteous. 3. This (37) (man) sold his-country (10) for gold (40). 4. Varus is a man (5) endued with the greatest (64) religion and the greatest (49) authority. 5. How (55) many (20) are unworthy (40) of light (27), and yet (20) the day (8) breaks. 6. I will not (56) ever descend (14) unworthy of (40) (my) grandfathers. 7. These were worthy of (56) so great (63) honour (49) at the hands of our ancestors (31). 8. An orator (8) ought (46) to be (38) (a man) of great (20) judgment (43), also of the highest (49) tact. 9. Soul and body are valued (5) at ten (44) asses daily ('in diem'). 10. For how much (59) can (50) it be bought (28)? For very little (abl.) (49).

LESSON LXX.

INDEFINITE PRONOUNS.

558. The indefinite pronouns are a class of determinative words which limit their nouns, expressed or understood, in an indefinite degree only. Of these, the most important and most frequently met with are *quis* and *qui*, *aliquis*, *aliqui*, *quisquam*, *quispiam*, *quidam*, and *quilibet.*

559. It will be noticed that *quis* and *qui*, limited by the aid of prefixes and affixes, serve to supply a large number of others.

560. *Quis* and *qui* usually follow a relative or particle, *quis* being used substantively and *qui* adjectively.

561. *Aliquis*, *aliqui* are a shade more definite than *quis*, *qui*, and do not need introductory particles.

562. *Quispiam* is less emphatic than *aliquis*, though rather more so than *quis;* its corresponding adjective is *nonnullus.* These two words are used in positive sentences, whereas *quisquam* and *ullus* are used in negative sentences, or in such as are in any way dubitative.

563. *Quidam* is in direct antithesis to *aliquis*, and implies that although its subject is indefinitely described, it none the less exists, and is occasionally used to mean 'some' as opposed to 'none.'

564. VOCABULARY 70.

English.	*Latin.*	*Derivatives.*
Law (human)	jus G. jūris, n.g.	
To fortify	mūnīre P. R. munīv	3rd R. munīt
Thief	fur G. fūris, c.g.	
Nor	neu, conj.	
To make	{condĕre (see 41) P. R. condĭd	3rd R. condĭt
To compose		
Robber	latro G. latronis (lit., hired servant)	

Adulterer	adulter	G. adultĕri		
To seek (on all sides)	anquirĕre	P. R. anquisiv	3rd R. anquisītum	
To love	dīligĕre	P. R. dilex	3rd R. dilect	
Perchance / Perhaps	forsĭtān, adv.			
Kind, of the	ejusmodi, n gen. of 'is modus			
Inheritance	hĕrēdĭtas	G. hereditātis		hereditary
To paint	pingĕre	P. R. pinx	3rd R. pict	
Some	non-nullus -la -lum (31), declined as one word			
Fish	piscis	G. piscis, m.g.		pisciculture
Fin / Feather	pĭnna	G. pinnae		
Four apiece	quaterni -nae -na, a distributive numeral			
Two apiece	bini -nae -na	"	"	
Idea	īdea	G. ideae		ideal
Lame	claudus -da -dum	R. claud		
Suitable	idōneus -nea -neum	R. idone		
To allege / To seize	apprĕhendĕre	P. R. apprehend		appreheas
It avails	attinet, impersonl form of attinĕre			
To come up with	assequi, dep.		3rd R. assecut	
Dancer	saltātor	G. saltatoris		saltatory
Motion / Movement	mōtus	G. motūs		motive
To spend (time)	ăgĕre	P. R. ēg	3rd R. act	
Disgraceful	dēdĕcōrus -ra -rum	R. dedecor		
Perhaps	fortasse, adv.			
Barren	jējūnus -na -num	R. jejun		
To expect	expectāre	R. expect		expectation
Issue (an)	prŏventus	U. proventūs		
Prosperous	secundus -da -dum	R. secund		
Accuser	accūsātor	G. accusatoris		
To twist	extorquĕre	P. R. extors	3rd R. extort	

565. EXERCISE 70.

A.

1. Si mala (33) condiderit in quem quis carmina (9), jus est. 2. Oppida (7) coeperunt (37) munire, et condere leges (5), ne quis fur esset, neu latro neu quis adulter. 3. Semper (33) aliqui anquirendi sunt, quos diligamus. 4. Forsitan aliquis aliquando ejusmodi quippiam fecerit (43). 5. Hereditas est pecunia (45) quae mortis (8) alicujus ad quempiam pervenit (19) jure. 6. Zeuxis tabulas (41) pinxit quarum nonnulla pars (1) usque (41) ad (67) nostram (39) memoriam (49) mansit (23). 7. Nullis (31) piscibus supra (67) quaternae pinnae sint quibusdam binae, aliquibus nullae (31). 8. In ideis Plato, quiddam divinum (33) esse dicebat (62). 9. Aegesilaus claudus fuit altero (31) pede (44). 10. Consules (17) inter (42) se (35) agitabant uti (= ut) alter (31) Samnites hostes (10), alter Etruscos diligeret, et uter (31) ad utrum bellum (16) dux (39) idoneus magis (38) esset.

B.

1. It avails nothing (31) to follow (63) anything which you are not able (56) to come up with. 2. I was born (44) at a certain time (17), I shall die (59) some time or other. 3. As (63) to a dancer, there is assigned (Lat., 'given,' 62) not any optional movement, but (6) a certain (38) definite one, so (50) must life (14) be spent in a certain (38) definite way (use 'genus'), not in any way we please. 4. This (37), however (Lat., 'utut') it is, I will suffer (45), although (50) it is disgraceful. 5. One who is dying (59) can (50) have some sense (49). 6. Perhaps this (37) something (Lat., 'nescio quod,' lit., 'I know not what') which I have done (use 'gerere,' 43) will seem (51) not barren and to be despised (49). 7. They err (46) who (use 'si quis') in war (16) expect all (29) issues of matters (63) to be prosperous. 8. Some one may say (62) that I (37) am unjust (57). 9. Pompey (60) used to fear (use imp. tense) (60) all (29) (things), that (see par. 488) you (37) might fear nothing (Lat., 'that-not anything'). 10. But (6) as (63) I had alleged anything, immediately (18) (my) accuser was twisting (it) out of (67) (my) hands (61).

LESSON LXXI.

PASSIVE VOICE USED IMPERSONALLY.

GERUNDIVES.

566. A proposition expressed by means of an active verb with its subject and object can be expressed by the passive voice; the object and the subject of the active voice becoming the subject and the agent respectively of the passive—as 'Amo te,' 'I love you,' becomes, in the passive, 'Amaris a me,' 'You are loved by me.'

567. If a verb govern a dative case of the person, and the proposition containing such a verb is to be expressed passively, the dative case cannot become the nominative; but it remains dative, and the third singular of the tense of the passive verb is used impersonally—as 'Credo vobis,' 'I believe you,' becomes, in the passive, 'A me creditur vobis,' which really means 'Credence (the cognate noun of credere) is given to you by me.'

568. Many verbs are used impersonally in the passive voice—as 'Curritur, 'It is run,' or 'They run'; 'Clamatur,' 'They exclaim.'

569. The future passive participle in 'dus' is never used impersonally if the verb be transitive and its object expressed. Thus, though we may say, 'Nobis legendum est,' 'We must read'; 'We must read books' would be 'Nobis libri legendi sunt.' From what has been said in 567, if the verb govern the dative case, the gerundive must be used impersonally like any other part of the passive voice.

570. If in the active voice we find two accusatives—one of the person and another of the thing—that of the thing remains unaltered when the proposition is expressed passively, as—'Rogor a te sententiam,' 'I am asked my opinion by you.'

571. Instead of the gerund with the proper case after it, authors (some more than others) change the sentence into its passive form, and use the participle in 'dus' or gerundive—as 'Consilium urbis delendae,' 'A design for the city to be destroyed,' instead of 'Consilium urbem delendi.'

572. VOCABULARY 71.

English.	*Latin.*		*Derivatives.*
To resolve	plăcēre	P. R. placu	3rd R. placit
To tell	nuntiare	R. nunti	annunciation
Labour	lăbor	G. labōris	laborious
Antium (of)	Antias	G. Antiātis	
To refuse	interdĭcĕre	P. R. interdix	3rd R. interdict
Sea	mare	G. maris	marine
Royal	regālis -le	G. regalis	regal
To cultivate	cōlĕre	P. R. colu	3rd R. cult
Custom	consuetūdo	G. consuetudĭnis	
To sacrifice	immolare	R. immol	immolation
To remain	restare	P. R. restit	3rd R. restit
To prevail upon	exōrare	R. exor	inexorable
To retain	rētinĕre	P. R. retinu	3rd R. retent
Office	officium	G. officĭi	officious
Voluntary	vŏluntārius -la -ium	R. voluntari	
To confess	confĭtēri, dep.		3rd R. confess
To assist	subvĕnire	P. R. subvēn	3rd R. subvent
Both—and	et—et, conj.		
To remove	tollĕre	P. R. sustŭl	3rd R. sublāt
Elegance	elĕgantia	G. elegantiae	
Opportunity	facultas (see 69)	G. facultātis	
To exculpate	purgare	R. purg	expurgation
To pray	ōrāre	R. or	oratory
Healthy	sānus -na - num	R. san	sanitary
Assembly	comitia, pl., n.g. (O decl.), of comitium, G. -tĭi, a place near the Forum where the elections were held		
To choose	subrōgāre	R. subrog	

573. EXERCISE 71.

A.

1. Mihi (35) ab istis (40) noceri (50) non potest (50). 2. Placitum est ut epistolae (7) nomine (20) principis (43) scriberentur (47). 3. Nuntiatum est

nobis (35) a Varrone venisse (19) eum (37) Roma. 4. Non parcetur (57) labori (Cic.). 5. Interdictum est mare Antiati populo (16). 6. Nihil (31) Xenophonti tam (58) rēgale videtur (51) quam (48) studium (30) agri (5) colendi. 7. Quis (38) ignorat (55) barbaram (45) consuetudinem hominum (18) immolandorum. 8. Timotheus belli (16) gerendi (16) peritus (46) est neque (54) minus (51) civitatis (14) regendae (4). 9. Restat Chremes qui (27) mihi (37) exorandus est. 10. Regulus retinendi officiit causa (37), cruciatum (54) subiit (56) voluntarium.

B.

1. So (50) we go (56) to (67) the stars (61). 2. Every (29) animal (27) must be confessed to be (38) immortal (40). 3. Not only (31) the body (15) must be assisted, but (6) the mind (40) and the soul (54) much ('multo') more (38). 4. We both created (37) the Decemviri (50) for writing (47) the laws (5) and removed (them) from (67) the Republic (45) within (67) ten (44) years (17). 5. Every (29) elegance of speaking (52) is increased (60) by reading (6) the orators (8) and poets (7). 6. In scorning (52) pleasure (49), virtue (26) is especially ('vel maxime') perceived (37). 7. It is being debated (Lat., 'agere') whether (53) an opportunity for oppressing (40) the Republic (45) be given (62) to M. Antony (Antonius). 8. The Aedui send (43) ambassadors (41) to (67) Caesar for the cause (37) of exculpating themselves (35). 9. We must pray that there may be a healthy mind (40) in a healthy body (15). 10. Valerius the Consul (63) held (49) an assembly for choosing a colleague (26) (use dative case).

(To be continued.)

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Chemistry of the Non-Metallics.

[This series of articles, whilst dealing with the subjects required by the University of London for the Matriculation Examination and with those required at the Elementary Stage of the Inorganic Chemistry (Branch X.) Science and Art Department, is intended as a practical guide to the philosophical and systematic study of the non-metallics.]

CHAPTER XV.

CHLORINE: χλωρος (chloros)=green. PREPARATIONS. PROPERTIES.

A. Cl.

B. 35½.

C. FIRST PREPARATION.—From manganese dioxide and hydrochloric acid.

1. Arrange an apparatus as in Fig. 43. The left-hand flask contains a quantity of manganese dioxide (black oxide of manganese). The middle vessel is a wash-bottle containing water. Pour on the black oxide impure commercial hydrochloric acid. Heat gently. Chlorine gas is evolved and can be caught by downward displacement of air, or over hot water in which common salt has been dissolved. Manganese chloride and hydrogen oxide or steam are formed at the same time.

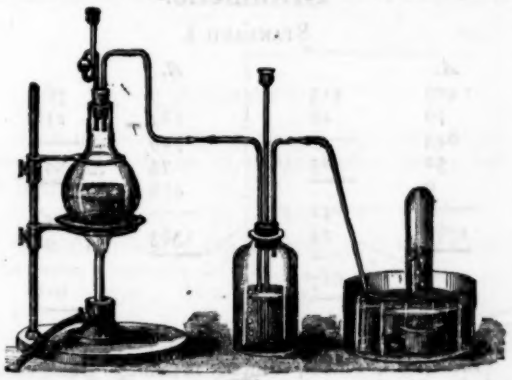


Fig. 43.

2. $MnO^2+4HCl=MnCl_2+2H_2O+Cl^2$.
3. 87 +146 =126 +36 +71.
2 vols.

SECOND PREPARATION.—From sodium chloride, manganese dioxide, and sulphuric acid.

1. The same apparatus as that used in the last experiment employed. The three substances just named are introduced into the flask, and gentle heat applied. Manganese sulphate, hydrogen oxide, and chlorine are joined. The sulphates remain in the flask. The steam is condensed in the wash-bottle, and the chlorine is caught as usual.

2. $MnO^2+2NaCl+2H^2SO^4=MnSO^4+Na^2SO^4+2H^2O+Cl_2$.
3. 87 +117 +196 =151 +142 +36 +71.
2 vols.

THIRD PREPARATION.—From hydrogen chloride.

1. The electrolysis of hydrogen chloride (hydrochloric acid) in a manner similar to that in which water is decomposed yields the two gases, hydrogen and chlorine. The former goes to the negative pole, the latter to the positive.

2. $2HCl=H_2+Cl_2$.
3. 73 =2 +71.
2 vols. 2 vols.

D. 1. Gas: liquefied under a pressure of 6 atmospheres.
2. Irritating, poisonous odour; green-yellow colour.
3. 35½ or $\frac{35\frac{1}{2}}{14{\cdot}47}$.
4. Soluble in water; 100 cc. of water dissolve 200 cc. of chlorine. The solution called chlorine-water is much used in testing.
5. Not combustible. If a compound of hydrogen and carbon is heated in chlorine, as when a piece of paper soaked in turpentine ($C^{10}H^{16}$), or a lighted candle, is plunged in the gas (Fig. 44), burning takes place. The chlorine joins with the hydrogen of the turpentine, or of the candle, to form hydrochloric acid, and the carbon is set free as soot. A jet of hydrogen may be burnt in chlorine. Hydrochloric acid gas results.

$$H^2+Cl^2=2HCl.$$
$$2+71=73.$$
2 vols. 2 vols. 4 vols.

Phosphorus, antimony, and copper (if the two latter are finely powdered) will also burn in chlorine, and chlorides of these elements are formed.

6. Chlorine bleaches vegetable colours. A piece of moistened litmus paper is bleached when placed in the gas. The presence of water is necessary. The chlorine decomposes the water, uniting with its hydrogen to form hydrochloric acid, and the nascent oxygen, set free from the water, combines with and oxydises the vegetable colour-matters, forming colourless compounds. The solution of chlorine in water also bleaches.

$$2H^2O+2Cl^2=4HCl+O^2$$
$$36 + 142 = 146 + 32.$$

Silver nitrate is precipitated by this solution, as the silver chloride (AgCl) that is formed is insoluble in water.

Chlorine with water also decomposes salts of its allies bromine and iodine, liberating those elements and forming chlorides of the metals previously united with the bromine or iodine.

$$2KBr+Cl^2=2KCl+Br_2$$
$$238+71=149+160$$
2 vols.

If paper soaked in a solution of potassium iodide and starch is plunged into chlorine, a blue colour is produced, as the chlorine sets free the iodine, and this combines with the starch.

E. F. COMPOUND WITH HYDROGEN.—*Hydrogen chloride, hydrochloric acid.*

a. HCl.

b. $36\frac{1}{2}$.

c. FIRST PREPARATION.—From hydrogen and chlorine.

1. Mix equal volumes of hydrogen and chlorine in a darkened room, in a small, *very strong*, wide-mouthed bottle. Close the bottle with a piece of plate-glass well greased, and expose it to diffuse daylight. The two gases unite.

2. $H^2 + Cl^2 = 2HCl$.

3. 2 + 71 = 73
2 vols. 2 vols. 4 vols.

SECOND PREPARATION.—From common salt and sulphuric acid.

1. Arrange an apparatus like that used in the making of chlorine. Place in the flask common salt, and pour on it sulphuric acid diluted with water (acid 2 to water 1). Heat gently. Sodium sulphate is formed and remains in the flask. Hydrogen chloride is evolved. It must be caught by displacement of air.

2. $NaCl + H_2SO_4 = Na^2SO_4 + 2HCl$ (manufacturing)

3. 117 + 98 = 142 + 73
4 vols.

or $NaCl + H^2SO^4 = NaHSO^4 + HCl$ (laboratory).
$58\frac{1}{2}$ + 98 = 120 + $36\frac{1}{2}$
2 vols.

d. 1. Gas: liquefied under a pressure of 40 atmospheres.

2. Irritating: colourless.

3. $18\frac{1}{4}$ or $\frac{18{\cdot}25}{14{\cdot}47}$.

4. Very soluble: fumes in air as it takes moisture from the air: 100 cc. of water dissolve 450 cc. of the gas. Ordinary hydrochloric acid is this solution. As the water absorbs the gas, an increase of bulk and a rise of temperature occur. Specific gravity of the concentrated solution, 1·21.

By replacement of the hydrogen in this compound by metals, chlorides are formed.

HCl = hydrogen chloride.
KCl = potassium ,,
H^4NCl = ammonium ,,
$BaCl^2$ = barium ,,
$BiCl^3$ = bismuth ,,
$PtCl^4$ = platinum ,,

Tests for Chlorides.

1. $+BaCl^2$ = no result.

2. $+AgNO^3$ = white precipitate. Insoluble in nitric acid, soluble in ammonia, turning violet on exposure to light.

$NaCl$ (*e.g.*) $+ AgNO^3 = NaNO^3 + AgCl$
$58\frac{1}{2}$ + 170 = 85 + $143\frac{1}{2}$.

3. $+MnO^2 + H^2SO^4$ an evolution of chlorine, recognised by odour and bleaching action.

$2NaCl$ (*e.g.*) $+ MnO^2 + 2H^2SO^4 = Na^2SO^4 + MnSO^4 + 2H^2O + Cl^2$
117 + 87 + 196 = 142 + 151 + 36 + 71
2 vols.

5. Not combustible, nor a supporter of combustion.

6. Acid to moist litmus paper.

Treated with ammonia, yields dense fumes of sal-ammoniac (ammonium chloride).

$HCl + H^3N = H^4NCl$.
$36\frac{1}{2}$ + 17 = $53\frac{1}{2}$.

Passed over red-hot iron, iron chloride is formed and hydrogen liberated.

$Fe + 2HCl = FeCl_2 + H^2$.
56 + 73 = 127 + 2
2 vols.

EXAMPLES ON CHLORINE. (*Solved.*)

101. The products of the action of hydrochloric acid on manganese dioxide weigh 466 grams. What weight of the oxide has been decomposed?

With 126 + 36 + 71
= 333 grm. weight of products, 87 grm. MnO^2 are decomposed.

1 ,, ,, $\frac{87}{333}$,, ,,

466 ,, ,, $\frac{87 \times 466}{233} = 174$ grams.

102. In the preparation of chlorine from common salt, it is found that 18 more grams of manganese sulphate are formed than sodium sulphate. What weight of salt was decomposed? what volume of chlorine was evolved? Temperature 26°. Pressure 703 mm.

When 151 grams $MnSO^4$ are formed, $142Na^2SO^4$ are formed, the excess is 9 grams.

With an excess of

9 grams, 117 grams NaCl are decomposed, and 22·24 litres Cl evolved at 0° and 760 mm.

1 gram, $\frac{117}{9}$,, ,, $\frac{22{\cdot}24}{9}$,,

18 grams, $\frac{117 \times 18}{9}$,, ,, $\frac{22{\cdot}4 \times 18}{9}$,,

$\therefore$ 234 grams NaCl.

299 volumes at 26° become 273 at 0°
1 volume ,, become $\frac{273}{299}$,,
$\frac{22{\cdot}4 \times 18}{9}$ volumes ,, become $\frac{273 \times 22{\cdot}4 \times 13}{299 \times 9}$ at 0°.

Under pressure 760 mm., volumes $= \frac{273 \times 22{\cdot}4 \times 18}{299 \times 9}$

1 volume $= \frac{273 \times 22{\cdot}4 \times 18 \times 760}{299 \times 9}$

703 volumes $= \frac{273 \times 22{\cdot}4 \times 18 \times 760}{299 \times 9 \times 703}$
$= 44\frac{18}{703}$.

EXAMPLES ON CHLORINE. (*For solution.*)

103. The chlorine gas given off as the result of pouring hydrochloric acid on manganese dioxide is dissolved in water. The water required to take it up is found to be 22,400 cc. What weight of oxide has been decomposed?.....$43\frac{1}{2}$ grams.

104. What will be the weight of the substances that are to be used for preparing $41\frac{1}{11}$ litres of chlorine from common salt, the temperature being 26° and the pressure 896 mm?—8 hectograms.

105. How much silver nitrate is required to completely precipitate 149 grams of potassium chloride?.....340 grams.

106. 60 cc. of hydrogen, and 50 cc. of chlorine are exploded. What volume of which gas remains?.....10 cc. of hydrogen.

(*To be continued.*)

—o—

Recent Inspection Questions.

Arithmetic.

STANDARD I.

A.		*B.*	
409	413	9	763
76	28	84	218
843		729	
52	385	73	545
9		468	
	641		954
1389	24	1363	28
	617		926

Dictation.

Little, girl, school, winter, morning, grass, white wind, cold, along.

STANDARD II.

Two divisions, *A* and *B*.

A.	*B.*
98,017	83,016
8,036	9,020
89,981 Ans.	73,996 Ans.
9,863 × 86	8,769 × 79
= 848,218 Ans.	= 692,751 Ans.
89,035 ÷ 7	63,074 ÷ 8
= 12,719$\frac{2}{7}$ Ans.	= 7884$\frac{2}{8}$ Ans.

STANDARD III.

(*A card.*)

(1) Take eight thousand nine hundred and seven pounds ten shillings and eleven pence farthing from seventy thousand eight hundred and nine pounds six shillings and fourpence farthing.

£70,809 6s. 4¼d. − £8,907 10s. 11¼d.
= £61,901 15s. 5d. Ans.

(2) Divide 809,642 by 308.

2628$\frac{218}{308}$. Ans.

(3) In a school there are 360 children. Of these 114 pay fourpence per week, and the rest threepence per week. How many pence does the school get in a week?

360 − 114 = 246
(114 × 4) + (246 × 3) = (456 + 738)
= 1194d. Ans.

(4) Add together £42 17s. 3¾d.; £437 19s. 6½d.; £25 9s. 2¾d.; £49 17s. 8½d.

£556 3s. 9½d. Ans.

STANDARD IV.

(*A card.*)

(1) Multiply £679 18s. 7½d. by 59.

£40,115 18s. 10½d. Ans.

(2) If a wheel is sixteen feet round, how many times will it turn round in going 52 miles?

(52 × 1760 × 3) ÷ 16
= 17,160 times. Ans.

(3) Reduce 187,149 half ounces to cwts.

52 cwts. 24 lbs. 6½ oz. Ans.

(4) Divide eight hundred and seventy-nine thousand and two pounds and sevenpence halfpenny by 69.

£879,002 0s. 7½d. ÷ 69
= £12,739 3s. 2¼d. $\frac{23}{69}$ Ans.

STANDARD V.

(1) A boy had an apple: he gave ¼ to each of his three sisters, and ⅒ to his brother; what fraction had he left?

1 − (¾ + ⅒) = $\frac{1}{20}$. Ans.

(2) Fifteen horses can do some work in 7½ days: how many horses can do it in 22½ days?

days.	days.	horses.	horses.
22½ :	7½ ::	15 :	5 Ans.

(3) Find the value of 12 acres 3 roods 26 poles of land at £6 10s. per acre.

	£	s.	d.	
2 r. = ½ a.	6	10	0	value of 1 a.
		12		
	78	0	0	value of 12 a.
1 r. = ½ of 2 r.	3	5	0	„ 2 r.
20 p. = ½ r.	1	17	6	„ 1 r.
5 p. = ¼ of 20		18	9	„ 20 p.
1 p. = ⅕ of 5		4	8½	„ 5 p.
			11¼	„ 1 p.
	£84	6	10½	val. of 12 a. 3 r. 26 p.

(4) Make out a bill for the following:—

	s.	d.
7½ yds. ribbon at 9½d. per yd.	5	11¼
4¼ „ calico at 4¾d. „	1	8$\frac{3}{16}$
8 doz. reels at 6d. per doz.	4	0
3½ yds. flannel at 1s. 7d. per yd.	5	6½
	17	1$\frac{15}{16}$ Ans.

STANDARD VI.

(1) Reduce 2 cwt. 2 qrs. to the fraction of half a ton, and 7½d. to the dec. of £3 2s. 6d.

$\frac{\text{2 cwt. 2 qrs.}}{\text{½ ton.}} = \frac{10}{40} = \frac{1}{4} = .25$ Ans.

$\frac{\text{7½d.}}{\text{£3 2s. 6d.}} = \frac{15}{1500} = .01$. Ans.

(2) If I get 7·25 oz. for £3·125, what weight can be bought for 125 shillings?

£	s.	oz.	oz.
3·125 :	125 ::	7·25 :	14·5. Ans.

(3) What sum will amount to £540 10s. in 73 days at 3⅗ per cent. per annum?

£100 will make $\frac{73}{365}$ of 3⅗ = £$\frac{1}{25}$

£	£	£	£	s.	d.
100$\frac{8}{25}$:	540½ ::	100 :	536	12	8$\frac{870}{1259}$.

(4) Simplify:—

$\frac{3\frac{1}{4} + 5\frac{1}{2}}{3\frac{5}{8} - 2\frac{1}{2}} \times \frac{3}{11}$
$= 8\frac{3}{8} \div 1\frac{1}{8} \times \frac{3}{11}$
$= \frac{67}{8} \times \frac{8}{9} \times \frac{3}{11}$
$= \frac{67}{33}$
$= 2\frac{1}{33}$. Ans.

STANDARD VII.

(1) The average age of eleven men is 44 years. Four of them are 50, and three are 60; what is the average age of the remaining men?

44 × 11 = 484 total years.
484 − (50 × 4 + 60 × 3) = 484 − 380
= 104 years for remaining four;
104 ÷ 4 = 26 average age.

(2) By selling a horse for £45 I lose 10 per cent of the original price. What did the animal cost?
For every £100 cost price, I receive only £90.
Therefore if I get £45 I should have paid

£90 : £45 :: £100 : £50. Ans.

(3) If 5 men can reap 15 acres by working 8 hours a day, how many hours a day must 12 men work to reap 35 acres?

men	12 :	5	:: 8 :	7½. Ans.
acres	15 :	35		

(4) £173 5s. is to be divided among 5 men and

some women. A woman's share is equal to $\frac{1}{3}$ of a man's share. How many women were there if each man got £24 15s.?

The men got £24 15s. × 5 = £123 15s.
The women got £173 5s. − £123 15s. = £49 10s.
Each woman got £24 15s. ÷ 3 = £8 5s.
The no. of women was £49 10s. ÷ £8 5s.
= 6 women. Ans.

Grammar.

STANDARD II.

Alternate boys picked out nouns from pars. 2 and 3, page 74, and verbs from first five lines page 103, Blackie's 'Comprehensive Reader,' Stand. II.

STANDARD III.

Alternate boys picked out verbs and adjectives, or pronouns and adverbs, from eight lines of prose from 'Royal History Stories,' page 74.

STANDARD IV.

Alternate boys parsed the following sentences from the poetry for recitation:—

(*a*) 'A stranger filled the Stuarts' throne.'
(*b*) 'He begged his bread from door to door.'

STANDARD V.

Letters *A*, *B*, and *C* given to successive boys.

Those with *A* parsed 'There was a sound of revelry by night.' Those with *B* parsed 'His heart more truly knew that peal too well.' Those with *C* made adjectives from *beauty*, *stone*, *man*, *impetus*, *chivalry*, *awe*, *mountain*, *prophet*.

STANDARDS VI. AND VII.

Section *A* analysed, 'The party *'gainst* the *which* he *doth contrive* shall seize one-*half* his goods,' and parsed the words in italics.

Section *B* took prefixes from the passage, 'Tarry, Jew. . . . Duke,' on page 76, Longman's *Merchant of Venice*, and gave their meanings.

Geography.

STANDARD I.

Specimens of Questions.

What is a plan? What kind of plan do you call this (pointing to ground plan)? Are there any other kinds of plans? Could I draw any kind of plan of the school if I stood outside in the yard? Does a ground plan show the shape of the door? of the windows? How do we know the size of the building by a plan? What sort of scales can we draw? If one boy had a big slate and the other a little one, could they both draw a plan on their slates? What would be the difference in their plans? This school is sixty feet long; could a boy draw a plan of it an inch to the foot on his slate? Why? How big would the plan be an inch to the foot? A half-inch? A quarter-inch? On which side is the side of the building I point to? Show me the north wall. The south. The west. What is this corner called? This? And this? (pointing successively to N.E., S.E., and S.W.).

STANDARD II.

Where do rivers come from? What is the place called where they rise? Where do they flow to? Where is a river biggest, at its source or at its mouth? Why? What is a tributary? What is the difference between the water of a river and the water of the sea? What makes the difference? Is there a river near here? What is it called? What makes the water in that river sometimes high and sometimes low? Is the water always of the same taste? What is the bottom of a river called? Here is a hollow; if that were the bed of a river, what would the sides be called? What do you call the piece of water generally situated among the mountains? What would you call a piece of land in the middle of it? A piece of land nearly surrounded by water? Another name for a cape? Another? Another?

STANDARD III.

Section A.—What county do you know north of the mouth of a large river on east coast? What river runs into the Wash? What is the chief range of mountains in England? What does it form? What is a watershed? Is there any watershed in the south of England? Where do the waters flow to the north of the South Downs? And to the south of it? What rivers flow from the east of the Pennine Chain? From the west of it? What part of the sea do they flow into? In which direction does the Great Ouse flow? What river flows into the Bristol Channel? Where does it rise? What range of mountains is that peak in? What other rivers drain the water from the Cambrian hills? What port is there at the mouth of the Taff? What do the people do in the south of Wales? Where are there other coalfields besides Wales? Is it likely there is coal under this school? If so, what coalfield are we on?

Teacher was then asked to put questions to the class.

Section B drew a map of the county in which the school was situated.

STANDARD IV.

Maps of *England*, *Ireland*, and *Australia* were given to *Section A*.

Section B ('World at Home Reader' open in Inspector's hands).—Why is Ireland called the Emerald Isle? What makes it so green? What surrounds Ireland? What land is there on the other side of the Atlantic? How many counties in Ireland? Any other divisions? How many provinces? Their names? Situation? Which is the manufacturing province of Ireland? What towns are in the basin of the Shannon? Largest lake of Ireland? What place is visited for its scenery? Name some of the mountains of Ireland? Where are the Mourne Mnts.? Which is the greatest manufacturing town in Ireland? Where is the county of Donegal? Cork? Galway? If I were to ascend in a balloon, what difference should I see between Ireland and Scotland?

STANDARD V.

1. Maps of France, Spain and Portugal, Italy, and Scandinavia, given to half class.

2. ('World at Home Reader' open in Inspector's hand.)—Where is this monument? (Waterloo). What happened there? What is this man called? (Cossack). Where does he come from? Which of the Cossacks are most noted? What is the Don? Into

what sea does the Don flow? What strait is there between Azov and Black Sea? Name the isthmus near? The peninsula? What large port is there in the peninsula? What tree is this? (pointing to cork-tree). Where does it grow? What else grows there? What is done with esparto grass? Name a port in Spain? One in the north? What do we get from Bilbao? Why do we use that iron? What is this building? (Coliseum). Where is it? What is it? Is it used now? When was it used? By whom? What for? What were the men called who fought in it? What is this (glacier)? What is a glacier? Why is it called an ice river? Name any river that rises in a glacier? Trace its course? Another river from same glacier? Name of town where river flows south? Port near its mouth? What are the Netherlands? Why are they flat? What sort of soil are they composed of? What are dykes?

Teacher then questioned on Austria.

STANDARD VI.

1. Maps of India, Africa, New Zealand, S. America, and Canada drawn by half-class.

2. Questions by Inspector from 'World at Home.'—What is this a picture of? (wall of China). How long is it? What is it for? Did Tartars ever invade China? What nation does the Emperor of China belong to? Where does bamboo grow? Sago-palm? Which part of it is the sago? In what countries is rice grown? Kind of soil fit for rice? What countries produce tea? Would tea and rice grow in same place? Why? What are the productions of Africa? Climbing the mountains, what would be the last sign of vegetable life you would find? Where is Cape Horn? Near what strait? Why so called? What country is there to the north? What do you know of the Patagonians? Describe the Arctic Ocean? What do you know of the North-east passage? Who has sailed it lately? Name some rivers in Siberia? Are they long or short? Why is there no trade with Siberia? Name a port in S. America? Another? One in Chili? One in Peru? Capital of Peru? A river running south in S. America? A town near its mouth? Where is Rio Janeiro? What is Monte Video?

STANDARD VII.

1. Map of Atlantic.

2. What are these lines? (pointing to isotherms). Why are they not straight? What is an isothermal? What other lines are there on physical maps? Where do you find corals? Beyond what depth do they die? If they cannot live beyond that depth supposing you find coral rocks at 300 ft., what would you conclude? What is the effect of the sea upon the countries near it? What are the winds called which blow from the sea? From the land? If at the seaside at night, what breeze would be blowing? Why? What would you conclude from that? What is the general effect of the sea upon the land? What may the water of the sea be called? (a storehouse of heat). What effect have mountains on climate?

—o—

The Nääs Slojd.

BY MISS J. WARREN,

Inspectress of Infant Schools to the Leicester Board.

Continued from page 436.

IN addition to the five broad principles for the foundation of the Nääs Slöjd, given in my last paper, I now add five more. These ten principles will, I hope, put the matter fully before my readers, and go far in helping them to understand the *rules* upon which the models are arranged.

I wish it to be distinctly understood at the same time, that these are the *main* features of the scheme, not the *only* ones; numberless little points come crowding into my memory as I write, and were it not my object to give general information, rather than an abstruse technical knowledge of the subject, I should certainly dwell for a much longer period on these opening ideas.

My fifth point had, as you will remember, to do with a love of labour; it follows, therefore, without dispute, that to carry out this idea we need some rule like the following:—

The work chosen must correspond with the purpose in view:—

That is to say, the Slöjd must be of such a nature as to give a child a satisfaction in its performance; in plain words, it must interest the child. Mere mechanical operations will soon cease to do this, they pall upon the senses; hence the great advantage of a system such as that of Nääs, of infinite variety though so beautifully simple. Frœbel says, in the course of his works, that the play of childhood is the work of the future man; and while we are all agreed as to the truth of the remark, we know full well that, after a child leaves actual babyhood behind, something much more real than play is necessary to satisfy his growing physical activity. Slöjd, in my opinion, is the middle course, between the actual kindergarten and the time when a child quits school for ever, and enters the bread-winning contest with his fellow men; this time has in no preceding work been satisfactorily filled up, except with intellectual studies. The so-called technical schools fail to supply the want felt by all true educators; a properly adjusted system of handiwork, such as this of which I write, steps in and picks up the thread ends left from the earlier kindergarten training, and, not losing one, binds them into the workman or workwoman of the future.

The Slöjd shall be such as to give general dexterity.

This seventh head brings me to one of the great points of difference between Slöjd and a special trade; for if we consider for a few moments, we shall see that *no* trade taken by itself will teach *general dexterity*. Admitting that trade does something in dexterity, we must also admit that a very large number of trades must be pursued to get general dexterity; and this, for obvious reasons, would be impossible in or during the years of school life.

If there be any doubt on the subject, just suppose for an instant that we follow the basket-making or boot-making trade—I mention these two because, in both England and some countries of Europe, they are largely resorted to. In both, a careful analysis will prove that very few manipulations are necessary, and that in consequence these are repeated so often as to be not only monotonous but positively in-

jurious to the physical well-being of the child; the body in both occupations is in a cramped position, back bent, head thrust forward, and chest contracted. I might, indeed, pursue the subject, and prove that the perpetual study of one special trade in school years is not only not useful, but is really detrimental to the child's future; *trade capacity* is diametrically opposed to *general dexterity*.

We cannot, it is evident, gain our end by teaching one or many trades. We will, therefore, take as another leading principle, that—

The system shall be adapted to general requirements, and though elementary shall be complete.

Complete—for to keep a child constantly at work that he will never see finished (*e.g.*, nut and bolt work, boot uppers, etc.) is to give him labour without satisfactory result; the effect is that he loses heart, becomes despondent, dissatisfied, and discouraged. The real love of labour we are so anxious to instil is destroyed by such a course. The scheme must be elementary, because we deal in school life with the *elements* of all branches of study. My ninth point must be—

Self-dependence.

We must, in any model scheme of handiwork, provide that the child becomes more and more self-dependent. It is not enough that he is dexterous, or that his knowledge is great, if he is unable to use them. Ordinary school studies give the teacher no power to teach this great virtue of self-reliance, but by means of a thoroughly good Slöjd system this becomes very easy of attainment; the nature of the work tends to it, and the rule that requires a complete work also engages, that the work shall be so graduated and taught as to enable each scholar to begin and finish his work unaided. Teachers of the Nääs Slöjd are forbidden to do any part of the actual work; their task is to teach the use of the tools, watch over, instruct, and supervise the work. Thus, in no mean degree, is this self-dependence pleasantly forced upon the meanest pupil in the Slöjd class. Only by his own hand labour will the little model upon which he toils ever see completion; and with this end in view, he works from time to time with renewed hope and fresh vigour.

Teachers sometimes complained to Herr Otto Saloman, the director, that they were obliged to do some of the work in their system; but when he inquired into it more fully, he always found that the models were either too advanced, or arranged in too difficult a plan for working. His own success, in the Nääs Slöjd, was ever a tangible proof of the practicability of a real children's Slöjd, independent of extraneous help.

Another point in the founding of the scheme, and with this I shall close—

That order and exactness be inculcated.

It is highly important that children should be brought to a right appreciation of order and exactness. The homes of our children, unfortunately, do not tend to this direction; anything, therefore, that can be done at school to foster a love of it should certainly be done. By the means of their work we can instil the truth. Some of our cleverest and best workmen, by reason of never having learned its value, are useless. No work sells that is lacking in this respect; 'order is half the life.' The elements of a really æsthetic education are to be found in a true Slöjd; for every well-finished work is beautiful, and a child should be taught to think that the beauty lies in the hand labour more far than in the design or material.

In my next paper, I shall proceed at once to detail the *eighteen rules* that were chosen, upon which to plan a series of models from which to work.

It will be seen from the foregoing remarks that the Nääs system is in reality a formative discipline. It is a means to an end, that end being the future welfare of the child. The moral well-being is worked hand in hand with the Slöjd; indeed, its promoters go so far as to say that, where no Slöjd is taught it is utterly impossible to instil into the child's mind many important truths. Thus courage, perseverance, determination, strength, by easy and imperceptible steps, come to him, and prepare to fit him for the great battle of life, into which he must soon (painfully soon in most cases) enter. He is learning to stand alone; the dullest child may be encouraged by his Slöjd work. Perseverance, ever a necessary factor in success, is continued diligence. But in intellectual work alone the weak brains suffer by comparison; in hand labour such a child may distinguish himself. We, as teachers, hold it to be our duty to leave no stone unturned to uproot ignorance, and give our children a better, happier, and more useful life. Much can be done by means of Slöjd. The future belongs to the children. Tegnier says, 'The educator must be looked upon as an artist.' His is the noblest work of all; he works in the most precious material. When a smith destroys his work he can replace it; but he who wrongly trains a child destroys it for all time, even eternity, and though not punishable by law, he offends the God who created all living things.

Later on, we must consider

(*a*) The subjects, one or many, required.
(*b*) The purposes for which we introduce Slöjd.
(*c*) The amount of time to devote to it.
(*d*) The teacher to be chosen for it.

I purpose taking these after going through the eighteen rules already referred to above.

(*To be continued.*)

—o—

My Scholarship Answers.

BY P. G. ASBURY,

First on the Scholarship List, 1885.

Arithmetic.

1. (*a*) The same process is used in each case, but in the short form the multiplication and subtraction are worked mentally, *e.g.* :—

Long.	*Short.*
3)729(243	3)729
6	243
12	
12	
..9	
9	
.	

Threes into seven goes two; two threes are six; six from seven, one, etc.

(*b*) The L.C.M. of certain numbers is the smallest number into which they will all divide without remainder.

The G.C.M. of certain numbers is the largest number which will divide without remainder into them all.

(*d*) 6 men do a work in 4 days;
3 „ the „ 8 „

Proportion is called 'inverse' when one term *increases* as another *decreases*. Thus, in the given example, the number of days increases as that of men decreases.

2.
9852
9825
9582 } Largest.
9528
2589
2598
2859 } Smallest.
2895
49.728

3.

Expenditure.	£	s.	d.	*Receipts.*	£	s.	d.
90 days at 2 gs....	189	0	0	10,070 persons at 3d.	125	17	6
90 ,, 3s. 9d.	16	17	6	3 000 horses at 6d.	75	0	0
Gain ...	50	0	0	Carriages must have paid ...	55	0	0
	£255	17	6	To make the total	£255	17	6

The carriages at 1s. each...£55. or 1,100s. ;
∴ The number of carriages = 1,100.

4.

tons	cwt.	qrs.	tons	cwt.	qrs.
233	15	3	314	3	2
20			20		
4675			6283		
4			4		
18,703 qrs.			25,134 qrs.		

59 : 25134 :: £15 17s. or 317s.

59)25134(426s or £21 6s.
236
153
118
354
354
...

6. $\frac{2}{3}$ of $\frac{7}{10}$ of $\frac{1}{4}$ of 3s. 4d. > ·6 of ·07 of ·13 of 3s. 9d.
$\frac{2}{3}$ of $\frac{7}{10}$ of $\frac{1}{4}$ of 3s. 4d. > $\frac{6}{10}$ of $\frac{7}{10}$ of $\frac{13-1}{90}$ of 3s. 9d.
$\frac{2}{3}$ of $\frac{7}{10}$ of $\frac{1}{4}$ of 3s. 4d. > $\frac{3}{5}$ of $\frac{7}{10}$ of $\frac{3}{10}$ of 3s. 9d.
$\frac{1}{4}$ of 3s. 4d. > $\frac{9}{10}$ of 3s. 9d.
7½d. greater than 6d.

8. 50 lbs. at 2s. 8d. to gain 6½ per cent. must sell for 16d.
$\frac{170 \times 2s.\ 8d. \times 106\frac{1}{2}}{100}$ = price of 170 lbs. coffee.
1,700d. = price of 170 lbs. coffee.
Price per lb. = 10d.

9. 1st pump throws 150 gals. per min., or 9,000 per hour.
2nd ,, 350 ,, 21,000 ,,
Stream supplies 20,000 ,,
Nett amount emptied per hour = 10,000 gals.
,, ,, in 18 × 24 hrs. = 432 × 10,000 gals.
Thus at the end of 18 days the amount remaining is
4,800,000 − 4,320,000 = 480,000 gals.
The nett quantity now emptied per hour is 21,000 (2nd pump) − 20,000 (stream) = 1,000 gals.
Whence the balance of 480,000 gals. will be discharged in 480 hours or 20 days.

10. Sides as 1 : 2; Cubes as $1^3 : 2^3$ or 1 : 8,
Whence the content of the smaller tube is ⅛ of the sum, or
6,133,248 ÷ 9 = 681,472 cubic ft.

$\sqrt[3]{681,472}$(88 ft. = edge of smaller.
512

248 | 19200 | 169472 176 ft. = edge of larger.
1984 |
21184 | 169472
.....

12. (100 − 6½)% of C. P. = £18 15s.
(100 + 6½)% ,, = (?)
93½% : 106½% :: £18½ : £21½, or £21 5s.
5

13. 95
89
87
273 passes : 313 passes : : 100 children : 300 children.
3

14.

	ac.	day	ac.	ac.
A can do	3½ ÷ 5	in 1 =	⅞ =	105/120 in 1 day.
B ,,	2½ ÷ 4	in 1 =	⅝ =	75/120 ,,
C ,,	7¾ ÷ 8	in 1 =	31/32 =	116/120 ,,
		Total		296/120 ,,

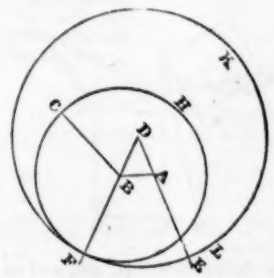
296/120 ac. in 1 day, 359 ac. in 160 days.
Ratio of A, B, C = 104 : 100 : 155.

A 104 = 104/359 × £359 14s. = £26. A.
B 100 = 100/359 × ,, = £25. B.
C 155 = 155/359 × ,, = £38 15s. C.

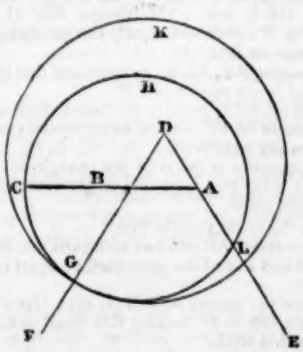
15. Int. in 3 per cents. is 3/100 × 3 = £51
1700 of 98 stock will only be 98/119 × 1700 of 119 stock, and the int. at 4 per cent. will be
14
98 × 1700/119 × 4/100 = £56
7
Gain = £5

Euclid.

1. Let A be the given point and BC the given line.



It is required to draw from A a straight line equal to BC.
Join AB.
Upon AB describe the equilateral triangle BDA (I. 1), and produce DA, DB to E and F.
From centre B with radius BC describe the circle CGH. And from centre D with radius DG describe the circle GKL.
Then AL drawn from A shall be equal to BC.
Because B is the centre of the circle CGH, BC is equal to BG; and because D is the centre of the circle GKL, DL is equal to DG; and the parts DA, DB are equal (I. 1);
Therefore the remainder AL is equal to the remainder BG.
But it has been shown that BC is equal to BG, wherefore AL and BC, being each equal to BG, are equal to one another.
Wherefore from the point A a straight line AL has been drawn equal to the given straight line BC.—Q. E. F.

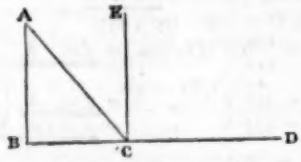


2. Let ABC be a triangle, and let one of its sides BC be produced to D.
Then the exterior angle ACD shall be equal to the two interior and opposite angles CAB, ABC.
Through the point C draw CE parallel to BA (I. 31).

Then because AC meets the parallel straight lines CE, BA, the angle ACE is equal to the angle BAC (I. 29).

And because DB meets CE, BA, therefore ECD is equal to ABC (I. 29).

But ACE was shown equal to BAC;



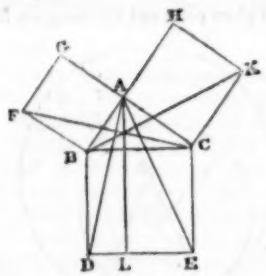
Therefore the whole exterior angle ACD is equal to the two interior and opposite angles CAB, ABC.—Q. E. D.

By I. 32, Cor., the 5 angles with 4 right angles are equal to 10 right angles, or 'twice as many right angles as the figure has sides.'

$$5x + 4 \times 90^\circ = 10 \times 90^\circ$$
$$5x = 6 \times 90^\circ = 540^\circ$$

Wherefore the angle of a regular pentagon is $540^\circ \div 5 = \underline{108^\circ}$.

3. Let ABC be a triangle with the angle BAC a right angle. Then the square described upon BC shall equal the squares described upon BA, AC.



On BC describe the sq. BDEC (I. 46), and on BA, AC the squares FA, AK. Through A draw AL parallel to BD or CE (I. 31), and join AD, FC.

Then, because BAC is a right angle (Hyp.) and BAG a right angle (def. 30), the two straight lines AC, AG upon the opposite sides of AB, make, at the point A, the adjacent angles equal to two right angles.

Therefore CA is in the same straight line with AG (I. 14). Similarly it may be shown that BA, AH are in the same straight line.

And because the angle DBC is equal to the angle FBA, add to each the angle ABC.

Therefore the whole DBA is equal to the whole FBC. And because the two sides AB, BD are equal to the two sides FB, BC each to each, and the included angle ABD equal to the included angle FBC; therefore the base AD is equal to the base FC (I. 4) and the triangle ABD to triangle FBC.

The parallelogram BL is double of the triangle ABD (I. 41); and the square GB is double the triangle FBC (I. 41). And since the doubles of equals are equal, the parallelogram BL is equal to the square on BA.

Similarly by joining AE, BK it can be proved that the parallelogram CL is equal to the square on AC.

But the square on BC is equal to the parallelograms BL, CL. Therefore the square on BC is equal to the squares on BA, AC.

Wherefore 'in any right-angled,' etc.—Q. E. D.

If the square upon one of the sides of a triangle be equal to the squares upon the other two sides, the angle contained by these two sides is a right angle.

4. Let AB be the given straight line.

It is required to divide AB into two such parts that the rectangle contained by AB and one of the parts shall be equal to the square on the other part.

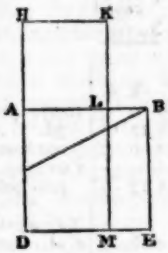
On AB describe the square ADEB (I. 46); bisect AD in C; join CB; produce DA to H, making CH equal to CB; on AH describe the square AHKL.

Then AB shall be divided in L, so that the rectangle AB,BL equals the square on AL.

Produce KL to M.

Because DA is bisected in C and produced to H, therefore the rectangle DH,HA, together with the square on CA, is equal to the square on CH (II. 6).

But CH is equal to CB (const.), therefore the square on CH equals the square on CB, which is equal to the squares on CA, AB (I. 47); therefore, also, the rectangle DH,HA, together with the square on CA, is equal to the squares on CA, AB; take away the square on CA, which is common; therefore the rectangle DH,HA, or the figure HM, is equal to the square on AB or the



square AE. From each of these equal figures take away AM; therefore the remainder HL, which is the square on AL, is equal to the remainder LE, which is the rectangle AB,BL.

Wherefore the given straight line AB has been divided in the point L, so that the rectangle contained by the whole, AB, and the part, BL, is equal to the square on the other part, AL.—Q. E. F.

Algebra.

7. (*a*) $(x^4+y^4)(x^4-y^4)$
$=(x^4+y^4)(x^2+y^2)(x^2-y^2)$
$=(x^4+y^4)(x^2+y^2)(x+y)(x-y)$.

(*b*) $(x-1)(x-1)(x-1)$.

(*c*) $(x+15)(x-7)$.

(*d*) $(-1-2)^2+(-2+3)^2+(3-1)^2=$
$(-3)^2+(1)^2 \quad +(2)^2 =$
$9 + 1 \quad + 4 =$
$\underline{14}$

8. (*a*) $\dfrac{(x-5x^2)(1-3x)}{(x-5x^2)(1+4x)} = \underline{\dfrac{1-3x}{1+4x}}$

(*b*)
$$\frac{a^2+b^2+c^2+2ab+2ac+2bc+a^2-2ab+b^2+b^2-2bc+c^2+c^2-2ac+a^2}{a^2+b^2+c^2}$$
$$=3(a^2+b^2+c^2) \div a^2+b^2+c^2 = \underline{3}$$

9. (*a*) Multiplying each term by 160:—
$64x+224 = 2000 - 80x - (35x-25) + 320$
$179x = 2121$
$x = \underline{11\frac{122}{179}}$.

(*b*) Multiplying each term by xy:—
$2y+3x=31xy$ } Difference equals:—
$5x-7y=31xy$ } $2x-9y=0$ $\therefore$ $3x=13\frac{1}{2}y$
By substitution in the first equation:—
$2y+13\frac{1}{2}y=31xy$ $\therefore$ $15\frac{1}{2}=31x$ $\therefore$ $x=\frac{1}{2}$
And since $2x$ has been shown equal to $9y$ $\therefore$ $\underline{y=\frac{1}{9}}$

10. Multiply both sides by $x(51-2x)$:—
$2x^2+(68-3x)(51-2x)=3x(51-2x)$
$2x^2+(68-6x)(51-2x)=0$
$2x^2+3468+442x+12x^2=0$
$14x^2+442x+3468=0$
$x^2+\dfrac{221x}{7}+\dfrac{1734}{7}=0$
$(x+17)(x+14\frac{2}{7})=0$
$x=\underline{-17}$ or $\underline{-14\frac{2}{7}}$

11. Let x = yds. per sec. quicker
And y = ,, ,, slower
$12(x+y)=440$ } Difference =
$60(x-y)=440$ } $48x-72y=0$ or $2x=3y$
By substitution in the first equation:—
$18y+12y=440$
$30y=440$

$y = \frac{44}{30}$ yds. per sec. or $\frac{44}{30} \times \frac{30^{2}\cdot 60\cdot 60}{1760\cdot 3} =$ 30 miles per hour slower train.

And because $2x$ has been shown equal to $3y$...45 miles per hour faster train.

Mensuration.

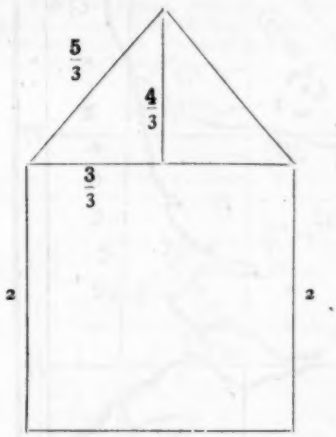
12. Given side..... 8 ft.
Let one side be x
Then the third side must be $16-x$ ft. to make the perimeter 24 ft.

8	„	12	=	4
x	„	„	=	$12-x$
$16-x$	„	„	=	$x-4$
2)24				
12			=	12

By rule, the root of product of these terms equals the area.

$\sqrt{4(12-x)(x-4)12} = 24$ Squaring,
$768x - 48x^{2} - 48^{2} = 576$ Dividing by 48,
$-x^{2} + 16x - 48 = 12$
$x^{2} - 16x + 60 = 0$
$(x-10)(x-6) = 0$
Wherefore 'the other sides' are 10. 6.

13. By the diagram and I. 47 it follows that the oblique boards are $\frac{5}{3}$ ft. wide.



ft.		ft.
$2(5\times 2)$	=area of sides	20
$2(5\times 1\frac{2}{3})$	= „ roof	$16\frac{2}{3}$
$2([2\times 2]+1\frac{1}{3}\times 1)$	= „ front and back	$10\frac{2}{3}$
	Total of sq. ft. at 3d. =	$47\frac{1}{3}$

Wherefore the cost of painting is 11s. 10d.

Geography.

1. Map of Scotland. See page 502.

2. PHYSICAL GEOGRAPHY treats of the earth without regard to the work of man.

POLITICAL GEOGRAPHY deals with the division of the earth's surface into countries, and with the government, occupations, etc., of the human race.

Degree of Latitude—One-ninetieth of the distance between Equator and Pole.

West Longitude—Distance west of Greenwich.

Tropic of Cancer—The zone extending $23\frac{1}{2}°$ north of the Equator.

Watershed—The land drained by a river and its tributaries.

Delta—The triangular island formed by the deposits of a river at its mouth.

Gulf Stream—The warm ocean current running north-east from the Gulf of Mexico, where it originates, to the shores of Europe.

That of Greenwich to be universally considered the prime meridian.

Greenwich mean-time to be generally accepted.

(The correct answer to the last part of the question is probably: The distinction A.M., P.M., to be discarded—'1 p.m.' to be called 13 o'clock, and so on to 24 o'clock, midnight.)

3. As we proceed eastward down the Thames, care must be taken to avoid the shallows and *sandbanks* which line the low shores of Essex and Kent. Turning northward and rounding the Naze, we skirt the coast of Suffolk and Norfolk; low cliffs of chalk and gravel alternate with stretches of sand; the *holder* shores are *yielding* to the sea, while the *sands*, on the other hand, *grow more extensive*.

Passing the shallow Wash, we sail round the low and uninteresting Lincoln coast, and arrive at the Humber. Rounding Spurn Head, and continuing north, we soon sight the prominent limestone rock, Flamborough Head. The shore remains rocky to the mouth of the Tees, but the Durham coast, with which our voyage ends, is less rugged.

4.

Colony.	Climate.	Productions. Animal.	Vegetable.	Mineral.
India	Tropical and sub-tropical.	Wool, hides, cashmere, ivory.	Rice, wheat, cotton, flax, hemp, coffee, spices, timber.	Gold, copper, iron, coal, salt, nitre, precious stones.
Dominion of Canada	Temperate and Frigid.	Meat, fur, fish, oil.	Corn and vegetables.	Copper, coal, marble, petroleum.
Australia	Tropical and Sub tropical.	Wool, hides, mutton.	Corn, cotton (Queensland)	Gold, copper, lead, iron, coal.
Cape Colony.	Sub-tropical.	Wool, hides, ivory, ostrich feathers.	Corn, wine.	Copper, diamonds (N. of Cape Colony).
West Indies...	Tropical.	Turtle (Bahamas).	Sugar, rum, cotton, tobacco, coffee, dyes, fruit, timber.	Copper (in small quantities), salt.
Gibraltar	Sub-tropical.	Rabbit, woodcock, partridge.	Orange, lemon, acacia.	
	Valuable as the 'Key to the Mediterranean.'			

5. *Sahara*—The great sand desert in the North of Africa.

Deccan—The triangular plateau of India bounded by the East and West Ghauts and the Vindhya range.

Plateau of Tibet—The great and high table-land extending north from the Himalayas to the Kuen-Lun mountains.

Great Karroo—The plain, almost rainless and with salt-impregnated soil, bounded on the north by the Nieuveld, and on the south by the Zwartebergen, in Cape Colony.

History.

8. Ashdown 871, Harold (II.) 1066, Rufus 1087, Evesham 1265, Death of Wallace 1305, Bannockburn 1314, Poitiers 1356, Pinkie 1547, Marston Moor 1644, James II. 1685, George I. 1714, South Sea Bubble 1720, Death of Wolfe 1759, Death of Nelson 1805, Catholic Relief Bill 1829, Ilbert Bill 1858.

9. *Statute of Præmunire* was an Act passed in the reign of Richard II., forbidding under heavy penalty the purchase of papal 'bulls,' etc.

Petition of Right.—This famous Bill, designed to check the autocratic rule of Charles I., became law in 1628. Charles' assent was forced from him, his third Parliament refusing to grant any money until their demands were complied with:—

(1) No taxes to be legal unless levied with the consent of Parliament.

(2) No persons to be punished for refusing to pay taxes not so legalised.

(3) Soldiers not to be billeted on private houses.

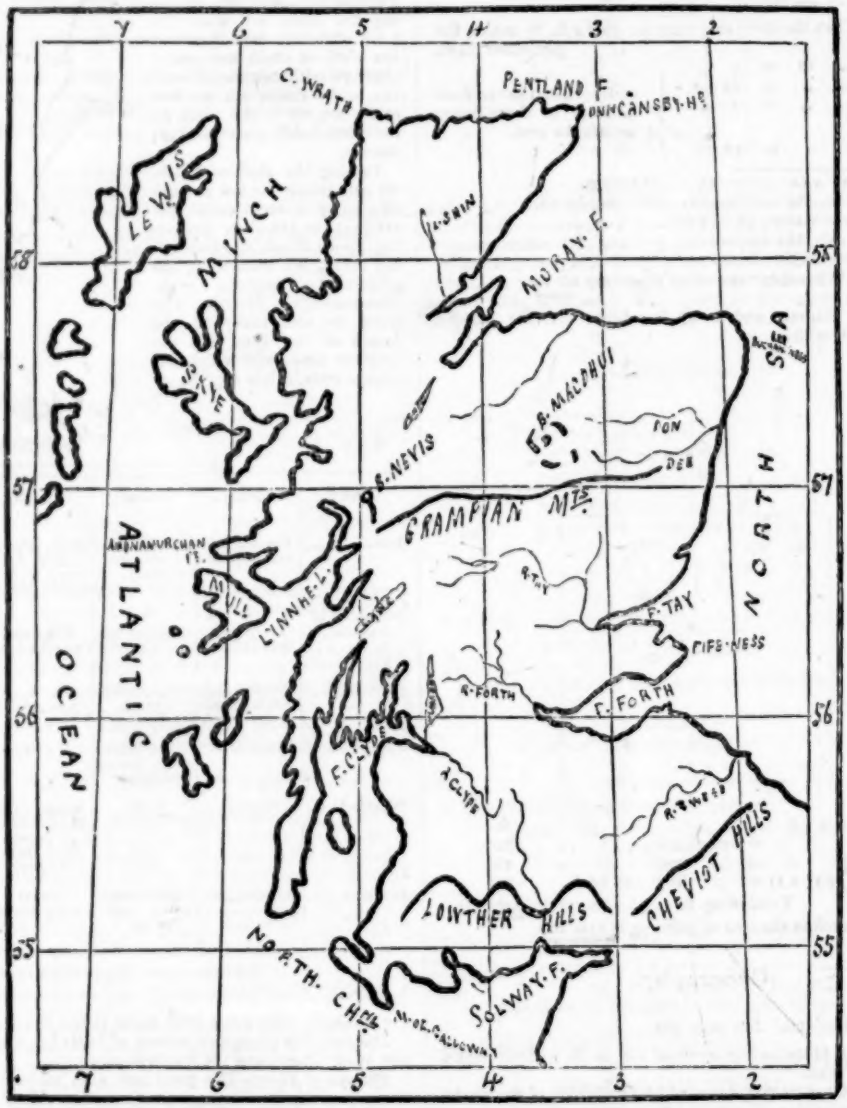
(4) Civilians not to be punished by martial law.

(4) That punishment by transportation be abolished.

Severe punishment was to be incurred by those who violated the provisions of this, the second great charter of English liberty.

10. HENRY V. was proud, ambitious, and warlike. As a youth he was wild and lawless, but in manhood, renowned for justice, courage, sagacity, he was equal'y worthy as king, warrior and statesman.

In 1415, he successfully besieged Harfleur; thence marching towards Calais he gained at Agincourt a brilliant victory over an army which outnumbered his, seven to one.



The Five-Mile Act was the last of the 'Clarendon Code.' It forbade ministers expelled as Nonconformists to approach within *five miles* of the scene of their former labours.

Habeas Corpus Act, passed in 1679, to prevent unjustified imprisonment, enacted:—

(1) That persons charged with any offence, save treason or felony, could demand to be brought before a judge that he might consider the validity of their detention.

(2) That persons charged with treason or felony must be tried at the next sessions after their committal, or else be freed on bail; and if not tried at the second sessions, they must be discharged.

(3) That no one could be recommitted for the same offence.

Four years later, Rouen surrendered to the English; and in 1420 was signed the Treaty of Troyes: Henry to marry Catherine, daughter of the French king, Charles; during the life of Charles to be his regent, and on his death to succeed him. Next year the dauphin attempted to regain his father's throne, but lost all hope when, in 1422, Henry captured the stronghold Meaux.

12. 1688—*Second Declaration of Indulgence* issued, accompanied with an order commanding the clergy to read it in their churches. Trial and acquittal of the *seven bishops*. *William of Orange*, invited by leading Englishmen, landed at Torbay. End of James' reign.

William requested by a great council to call a convention, and in the meantime to act as sovereign.

1689—*William and Mary* accepted the throne offered to them by the convention. Declaration of Rights, which became *Bill of Rights* when the convention was changed into a Parliament, completed the Revolution.

James landed in Ireland, and as France favoured his pretensions, war was declared against her.

The most noteworthy incident of the Irish Civil War was the unsuccessful siege of *Londonderry* by the rebels.

In Scotland, the partisans of James were headed by Dundee, who was killed, though his forces were victorious, at Killiecrankie.

13. SEVEN YEARS' WAR, 1756-1763.—Prussia held the province of Silesia claimed by Maria Theresa of Austria. England aided Prussia, while France and Russia allied with Austria. The war was chiefly confined to England and France, who fought for colonial supremacy in India and America.

India.—Clive, who in 1757 gained the glorious victory of Plassey over Surajah Dowlah, held the ambitious French in check.

America.—France lost Cape Breton and other colonies in 1758, and in 1759 Wolfe's victory at Quebec put the finishing stroke to the conquest by England of Canada.

In 1759, also, the French were defeated at Minden, and were twice beaten at sea by the English—Lagos and Quiberon Bay.

England captured many of the French West Indies 1761, and in 1762 took Havannah (Cuba) and Manilla (Philippines) from Spain, who had joined issue with France.

1763, Treaty of Paris:

England restored to France, Belle Isle, Martinique, and Guadaloupe, but retained all her other conquests.

England restored to Spain, Havannah and Manilla, receiving Florida in exchange for the former.

MUSIC.

TONIC SOL-FA.

1. Half value :— | s . f,m : r . ,f | m . r : . d ‖
   Double value :— | s : - | f : m | r : - | - : f }
   | m : - | r : - | : | d : - ‖

2. (1) Pluperfect 4th, or tritone.
   (2) Perfect 4th.
   (3) Augmented 2nd.

3. (1) *Strong:*— d m s.
   (2) *Leaning:*— t (up to d) f (down to m).

4. (1) | : : ‖
   (2) | : | : ‖
   (3) | : : | : : ‖

5. (1) ba. (2) s.

6. (1) Go back to X. (2) Sweetly.
   (3) Gradually softer. (4) Each note short.

School Management.

1. (2):—

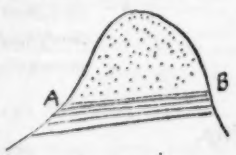
STANDARD II. *Time*—Half-an-hour.

Apparatus.—Black-board, etc.; tray with sand, clay, and jug of water.

(*a*) *Formation.*—'What becomes of all the rain?' Some is 'dried up' and some *sinks* into the ground.

Show that sand is pervious and deduce the meaning of pervious. Contrast sand with clay, illustrating with the water.

Describe such a hill as that shown in section, and liken to sand and clay: ask how far the rain-water can soak.



'Well, then, as the water can go no farther and more keeps sinking through, what will happen by-and-by?' The water must come out somewhere.

'Where?' At A. 'Why not at B?' Water can only run *down*.

Elicit that because the water *springs* from the ground we say that a *spring* is formed. If there be a spring near, the observation of the children may be tested. (In a first lesson it would hardly be advisable to speak of glacial and other formations.)

(*b*) *Course.*—'Suppose you saw the running water at a little distance from the spring, what would you call it?' A little stream, brook, rill, etc. 'Would you think that two rills would ever meet?'—

Spill water in two places on tray; then tilt the tray so that the streams meet, showing that the volume of water at the junction is equal to the sum of the first two volumes.

Refer to a neighbouring stream, if possible, and derive the lesson:—'Mony a mickle makes a muckle.'

'What boy has been to the sea-side?'

'Could you run quicker *to* the sea or *from* it?'

'Why?' The *ground slopes to the sea.*

It was given by the children that water 'can only run down,' so it follows naturally that rivers generally find their way to the sea.

A spring is very often the *source* of a river. 'What is meant by "source"?' Beginning.

The opening of a river into the sea is called the *mouth.*

'Which will be higher, *source* or *mouth?*'

Recapitulate.

3. THE ALPHABET.—It is more interesting and valuable for a child to *build up* words with the teacher's help, than to analyse them. Moreover, the latter operation would in most cases be too abstruse for beginners, and the learning of words would therefore be mere parrot-learning. Of course there are very many exceptions to the rules of spelling, but it is surely good mental exercise for a child to reason that because *n-o* spells *nō*, therefore *s-o* spells *sō*—even though it be necessary afterwards to tell him that *t-o* does not spell *tō.*

6. *1st Standard.*—How many farthings in 1 penny? How many in 6 pennies?

If I were to break 7 sticks of pencil each into 4 pieces, how many pieces should I have?

I gave 12 marbles to 3 boys, so that each boy had the same number; what was that number?

(Examples in addition and subtraction would be given in the ordinary arithmetic lessons.)

5th Standard.—What fraction of an orange would be half of the third?

One quarter of a cake being divided equally among 3 boys, what part of the whole would each boy get?

If a man give me £5 for lending him £100, what ought he give me if I lend him £120?

(Examples in practice, etc., would occur during the written arithmetic lessons.)

7. (1) To show Standard II. how day and night are caused, the meaning of equator, pole, latitude, longitude, distribution of land and water, etc.

To illustrate to Standards V. and VI. the phenomenon of the seasons, to show how latitude and longitude are determined, etc.

(2) To supplement a lesson on direction as determined by the sun.

(3) To show how the sailor finds his way at sea when neither sun nor stars can be seen. With senior boys to explain the theory of magnetism, and to show how the inference is drawn that the earth is a magnet.

(4) To show that expansion and contraction correspond generally to increase and decrease of heat.

An interesting lesson could be given to an upper class on the making of a thermometer, and might be followed by an explanation of what 'boiling' really is, and so how the height of a mountain may be approximately determined.

8. (1) By exaggerating the sound of *th*, final *d*, *t*, *ing*, etc., and, where necessary, requiring the child to watch the movement of the tongue, lips, and teeth.

(2) By example; by requiring the child to put down his book and *talk* the sentence poorly read; by exercise in picking out the emphatic words in easy sentences.

13. (*a*) On the elements of physical geography.

(*b*) On the use, etc., of animals and things—including the production of the latter—which the average child often sees or hears of.

(*a*) Day and night, simple effects of heat, evaporation and condensation, rain, a spring, a river.

(*b*) Corn, bread, the cow, butter and cheese, the sheep, wool.

14. *Decomposition.*—It is easily understood, and is logical.

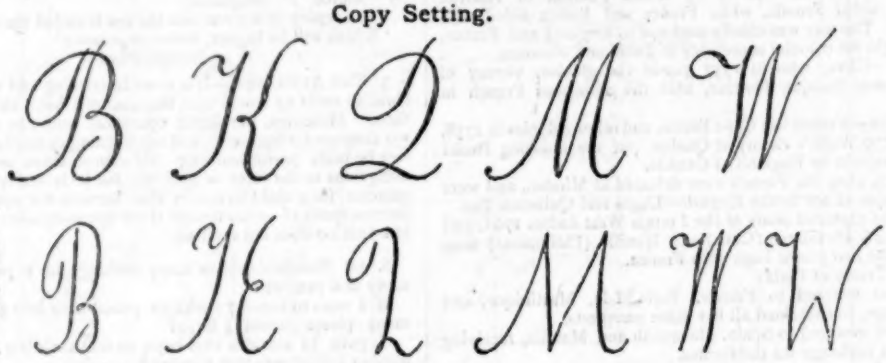
H.	T.	U.
Boxes.	Bags.	Marbles.
4^3	2^{11}	^{10}
2	3	5
1	8	5

We cannot take 5 from nothing, so must go to the bags; take 1 from the 2 and 1 remains. In the bag there are 10 marbles, and 5 from 10 leaves 5. 3 bags cannot be taken from 1; take 1 box, in which there are 10 bags; 3 boxes left, and there are now 11 bags; 3 from 11 leaves 8, 2 from 3 leaves 1.

15. The travellers *long* for home .....*Verb.*
The way is *long* .....*Adjective.*
As we *near* the shore, trees can be distinguished .....*Verb.*
Our house is quite *near* .....*Adjective.*
Harold was at first successful, *but* was finally defeated .....*Conjunction.*
The attempt would have been made by none *but* Nelson .....*Preposition.*
Henry was *but* wild, not vicious .....*Advb.*
That man is to be feared .....*Adjective.*
Evil be to him *that* evil thinks .....*Pronoun.*
John said *that* they might as well ask of him the crown.....*Conjunction*
Sweetly singing, the lark *rose*.....*Verb.*
The *rose* is queen of flowers ....*Noun.*
The *fly* clears away corrupt matter .....*Noun.*
Swallows with ease *fly* sixty miles an hour ... *Verb.*

16. Only to keep within bounds the pen of a child first using one. All such aids should be abandoned as soon as possible. so that the learner may not feel their loss too keenly when he has to been independent of them.

Copy Setting.



Common Blunders.

French.

1. On the 14th of June, at mid-day, the corvette *La Recherche* appeared in the port of The Havre preparatory to taking a voyage to Spitzburg. The sky was clear, the sea calm: a number of spectators had just arranged themselves along the quay, some to satisfy the sentiment of curiosity, others to bid us yet a last adieu. Fairly on the way,* we gazed alternately at the land of France, which gradually faded behind us, at the immense space which unrolled to our eyes, and in turns our thoughts went out from the past to the future, from the regrets of our affection to the desires † of voyage.‡

2. *Le* 14 *Juin*—Adv. of time, modifying 'appareillait.'
du { *de*—prep. gov. 'Havre.' / *le*—def. art., sing., masc., dist. 'Havre.'
Havre—prop. noun, sing., 3rd pers., masc., dat. case.
venaient—3rd pers., plur., imperf. ind. of 'venir,' an irreg. neut. verb of the 2nd conj.
d'autres—indef. pronoun, plur., 3rd pers., nom. to venaient de se ranger (understood).
nous (1)—pers. pron., plur., 1st pers., *dat.* case, ind., comp. to 'envoyer.'
debout—adv. modifying 'sur le pont.'
s'effaçait—3rd pers., sing., imperf. ind. of 's'effacer,' a reg. reflex. verb of the 1st conj.
nous (2)—pers. pron., plur., 1st pers., *nom.* case to 'regardions.'
nous (3)—pers. pron, plur., 1st pers, *dative* case after 'derrière.'
yeux—com. noun, plur., 3rd pers., masc., dat. case, ind., comp. to 'déroulait.'
s'en allait—3rd pers., sing., imperf. ind. of 's'en aller,' an irreg. reflex. verb of the 1st conj.
aux { *à*—prep. gov. 'désirs.' / *les*—def. art., plur., masc., distinguishing 'désirs.'
désirs—com. noun, plur., 3rd pers., masc., dat. case.

* Should be: 'on the bridge.' † Anticipations.
‡ Last sentence much too literal.

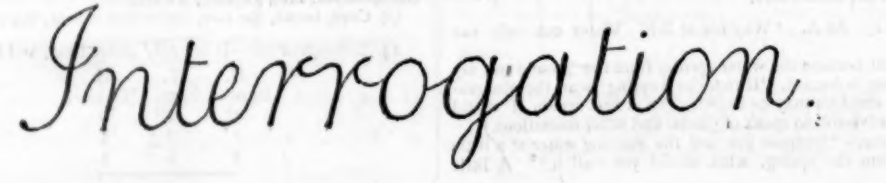
3.

Infinitive.	Imperfect Indicative.	Conditional.
être	j'étais, tu étais, il était nous étions, vous étiez, ils étaient	je serais, tu serais, il serait nous serions, vous seriez, ils seraient
prendre	je prenais, tu prenais, il prenait nous prenions, vous preniez, ils prenaient	je prendrais, tu prendrais, il prendrait nous prendrions, vous prendriez, ils prendraient
savoir	je savais, tu savais, il savait nous savions, vous saviez, ils savaient	je saurais, tu saurais, il saurait nous saurions, vous sauriez, ils sauraient
finir	je finissais, tu finissais, il finissait nous finissions, vous finissiez, ils finissaient	je finirais, tu finirais, il finirait nous finirions, vous finiriez, ils finiraient
vouloir	je voulais, tu voulais, il voulait nous voulions, vous vouliez, ils voulaient	je vaudrais,* tu vaudrais, il vaudrais nous vaudrions, vous vaudriez, ils vaudraient
tenir	je tenais, tu tenais, il tenait nous tenions, vous teniez, ils tenaient	je tiendrais, tu tiendrais, il tiendrait nous tiendrions, vous tiendriez, ils tiendraient

* Should be 'je voudrais,' etc.

4. année *passée*
travaux *différents*
parapluie *neuf*
ces ardoises
chambre *petite*
eaux *pures*
faim *grand*
promenade *preferable.*

Penmanship.



Then burst from that great concourse
A shout that shook the towers.

Composition.

4. Examinations may be considered under three heads, corresponding to the objects which they are designed to serve.

I. Examinations simply held to test the knowledge of the examined.

II. Examinations to determine the most deserving recipients for 'scholarships' and rewards in general.

III. Examinations to test the capability, etc., of the teacher of the examined.

I. This object is the primary one, and this kind of examination is plainly so useful that exception to it can scarcely be taken: the strong and weak points in the knowledge and understanding of the pupils being shown, the teacher may hope to make his work *tell*.

Of course great care must be taken to ensure *real* examination, otherwise the harm accruing may outweigh the good. If a child be allowed to *cheat*, there is at once, besides the blunting of his moral instincts, the loss of self-reliance—a loss indeed; if the work be *not accurately corrected*, the child is simply confirmed in error.

II. It has been said that because a certain candidate obtains most marks in a competitive examination, he is not necessarily the most praiseworthy one; also, that it is not even proved that he had most knowledge of the set subjects.

Before attributing all credit to the fortunate No. 1, we must certainly consider carefully what advantages he possessed and what disadvantages handicapped his rivals at the beginning of the race. Granting this, one can yet hold that the inference drawn from the result of a searching competitive examination is approximately correct.

III. Much care, then, has to be taken in conducting a simple qualifying examination, and more in a competitive one; but to decide by examination of the scholars whether or not a teacher has worked conscientiously and well is far more difficult, and needs the greatest amount of discrimination.

The evil tendency of 'payment by result' has been to make the reputation of a teacher—nay, his very bread—depend upon the number of 'passes' he can obtain in his class. Throughout the country teachers have protested against thus being forced, in self-defence, to drive knowledge in, rather than allowed to encourage observation, to help childish attempts at reason—in a word, to *educate*.

To judge the value of a teacher's labours by the returns of a superficial examination is to abuse examination, which, when rightly used, is a weighty power for good to teacher and to taught.

Grammar.

1.

There—adv. of place, here used simply for emphasis.
so—adv. of deg. mod. 'dead.'
hath—part of the reg. trans. verb 'to have,' aux. of tense.
said—past part. of the reg. trans. verb 'to say.'
hath said—verb, reg. trans., act. voice, pres. perf. tense, ind. mood, sing. num., 3rd pers., agr. with 'who.'
land—com. noun, sing. num., 3rd pers., neut. gen., nom. case after 'is.'
whose—rel. pro., sing. num., 3rd pers., masc. gen., agr. with 'man,' poss. case.
wandering—gerund, sing. num., 3rd pers., neut. gen., obj. case, gov. by 'from.'
breathe—verb, reg. int., pres. tense, subj. mood, sing. num., 3rd pers., agr. with 'such.'
go—verb, irreg. int., pres. tense, imper. mood, sing. or plur. num., 2nd pers., agr. with thou or you (understood.)
though—cop. cont. conj., connecting 'for him no minstrel raptures swell,' with 'his titles (be) high.'
wealth—com. noun, sing. num., 3rd pers., neut. gen., nom. case to '(be) boundless.'
as—cop. cont. conj., connecting '(though) his wealth (be) boundless,' with '(that which) wish can claim.'
despite—prep., gov. 'titles.'
self—com. noun, sing. num., 3rd pers., neut. gen., obj. case, gov. by despite (understood.)
all—adv. of deg., mod. 'concentred.'
go—verb, irreg. int., pres. infinitive.
whence—adv. of place, here used as rel. pro., sing. num., 3rd pers., neut. gen., agr. with 'dust,' obj. case, gov. by 'from.'
sprung—verb, irreg. int., past tense, ind. mood, sing. num., 3rd pers., agr. with 'he.'
unsung—compound participle—*un* = not, *sung*, past part. of irreg. trans. verb 'to sing'—att. to 'he' (understood).

2. ANALYSIS.

Sentence.	Kind of Sentence.	Subject.	Ext. of Sub.	Predicate.	Extension of Pred.	Object
(1) Breathes there a man with soul so dead	Princ.	A man	with soul so dead	breathes there		
(2) who never to himself hath said	Adj. Att. to 'man' (1)	who		hath said	never (time)	to himself (ind.)
(3) This is my own, my native land,	Noun Obj. to 'hath said' (2)	this		is my own, my native land		
(4) whose heart hath ne'er within him burned	Adj. Att. to 'man' (1)	whose heart		hath burned	ne'er (time) within him (place)	
(5) as home his footsteps he hath turned from wandering in a foreign land?	Adv. of circum. modg. 'hath burned' (4)	[as] he		hath turned	home, from wandering in a foreign land (place)	his footsteps
(6) If such there breathe	Adv. of Con. mod. (7) (8)	[if] such		there breathe		
(7) Go,	Princ.	(you)		go		
(8) mark him well,	Princ.	(you)		mark	well (man.)	him
(9) for him no minstrel raptures swell	Princ.	no raptures	minstrel	swell		for him (ind.r.)

3. Sir Walter Scott, the author of this poem, was himself so patriotic, that he asks if a man can *be* without an inherent love for country? To the poet's mind such a man would be without soul. Must not every man, at some time, have been filled with exultation at the thought expressed in the words, 'This is my own, my native land!'—if never else, surely this feeling would arise as one drew near the fatherland after long absence.

(Answer left unfinished.)

4.—Not attempted.

5. *Proper Nouns—Particular* names of persons and places, *e.g.*, John, London.

Common Nouns—Names *common* to all of a class, *e.g.*, boy, city, table.

Abstract Nouns—Names of qualities and other *abstract* things, *i.e.*, things not material, *e.g.*, mercy, time.

Cardinal Numbers—The simple numerals, one, two, etc.

Ordinal Numbers—Numbers denoting order, quality, etc., *e.g.*, first, second, third.

Intransitive and Neuter Verbs—'Intransitive' and 'Neuter' are synonymous.

(This answer is wrong: copulative verbs are neuter.)

Continuative Conjunctions—Join sentences and *continue* the meaning, *e.g.*, 'as'—

'Whose heart within him ne'er hath burned
As home his footsteps he hath turned.'

Disjunctive Conjunctions—Join sentences, but disconnect or contrast the meaning, *e.g.*, 'but'—'Their leader scaled the wall, *but* was hurled back.'

Personal Pronouns—Simply stand instead of the names of persons, *e.g.*, I, thou.

Possessive Pronouns—Also denote 'possession' of something understood, *e.g.*, mine, thine.

Reflexive Pronouns—Pronouns used as the objects of sentences where subject and object denote the same person, *e.g.*, 'himself'—'The boy hurt *himself*.'

Relative Pronouns—Pronouns which refer or *relate* to nouns or pronouns which precede, *e.g.*, 'that'—'Evil be to him *that* evil thinks.'

6. (*a*) That instead of words changing their form—nouns for *cases*, etc, verbs for *tenses*, etc.—the change of meaning is more often expressed now with auxiliary words.

(*b*) Nom., *I*; Obj., *me*; Poss., *my*.
1st Per., *I sing*; 2nd Per., *thou singest*; 3rd Per., *he sings*.
Pos., *rich*; Comp., *richer*; Super., *richest*.

7. *Subject*, William; *Predicate*, conquered; *Object*, England. A glance at this analysis shows that 'conquered' is a transitive verb, that 'William' is in the nominative case, and 'England' in the *objective* case, the syntax being—'William,' nom. to 'conquered'; 'conquered,' agreeing in num. and per. with 'William'; 'England,' gov. by 'conquered.'

Adverbs, etc, can be recognised by their position when the sentence is analysed, *e.g.*, *Subject*, The wind; *Predicate*, blows; *Extension*, keenly. 'Keenly' is an adverb of manner.

8. The English language is essentially Anglo-Saxon, which was introduced by the Angles, Jutes, and Saxons when they successfully invaded Britain during the fifth and sixth centuries.

The most important modifications were made—

I. After the Norman invasion of 1066.

II. At the revival of learning which began about the year 1500.

I. Little change was made in English *grammar*, the most important being the introduction of auxiliary words to supersede inflexion.

Most of the Norman-French words relate—

(*a*) To *war*, *e.g.*, army, array, assault, banner, battle, chivalry, fealty, lance.

(*b*) To *law*, *e.g.*, advocate, arrest, assize, chancellor, court, felony, plaintiff.

The following is an interesting comparison:—
Anglo-Saxon, ox, sheep, pig, calf.
Norman-French, beef, mutton, pork, veal.

II. The advancement of the study of theology made men seek for knowledge of the classical languages, and, as a consequence, from the time of Henry VII. to that of Charles II. there was an influx of Latin and Greek words into the English vocabulary.

Latin words of this period more closely resemble the originals than do those introduced by the Normans.

Latin.	Words through N.-F.	Words introduced at R. of L.
captivum	caitiff	captive
separare	sever	separate
factum	feat	fact
pungentem	poignant	pungent
securum	sure	secure
regalem	royal	regal

How to Teach Drawing in Elementary Schools.

BY T. K. ABLETT,
Superintendent of Drawing to the School Board for London.

FREEHAND AND SHADING.

Freehand.—We now come to consider freehand drawing. The term freehand has become restricted to what is really only a very small part of drawing with the unaided hand—to the drawing of outlines of decorative forms with pencil. In the second grade examination, freehand is narrowed down still further to the drawing of balanced or bi-symmetrical ornament. There is beauty in a bi-symmetrical arrangement, for it is that of the human figure, the most beautiful of all forms. But the human figure, though bi-symmetrical, exhibits considerable diversity in its details. Both hands, both eyes, both ears are seldom exactly alike, and never, I may venture to say, in a good figure by the sculptors of ancient Rome and Greece. To have both sides exactly alike appears to detract from perfect form.

However beautiful a bi-symmetrical arrangement is in its best exemplification, it is not the sum and substance of all beauty; and there is surely no advantage in confining the attention of pupils to this one feature of decorative art, through all the weary course (from infancy to adolescence) necessary to give sufficient skill to pass the second grade examination. As the balancing, or getting two sides alike, may easily be done with the aid of a piece of tracing paper, it is scarcely necessary to spend so much time in acquiring such skill with the free hand.

If this dreary course of copying lines (which is scarcely more interesting than writing a copy in a copy-book) gave a child any real power in drawing, we might overlook the fact that, contrary to sound principles of education, the pupil is set to copy conventional arrangements of plants before it has drawn the outlines of the plants themselves. An experienced educationalist wrote to me some time ago, saying, 'the continual practice of freehand is decidedly cramping to the pupils, and gives them a distaste for drawing.' In my own experience, I have never found that any great proficiency in freehand necessarily foreshadowed talent in drawing from objects or materially helped it. Indeed, those who willingly submit to a long course of freehand have few artistic capabilities, beyond a power of patient plodding-on without a goal in view.

It may be said that, if freehand, does not teach much of drawing it cultivates a liking for design. The weight of evidence is against this view, and if it were not, the teaching of design is a matter of slight importance in elementary schools. We cannot hope, were it desirable, to make all children designers, but we can train their faculties, and give them such skill in drawing as will be almost as useful in after life as are reading and writing.

Drawing is a means of rousing and developing certain faculties and perceptions, that would (without its practice) lie dormant. It affords a means of training the mind to attention and accuracy, which is of immense importance.

Are these great gains to be won by an unintellectual and dreary exercise such as freehand,

which disheartens those who should be encouraged, when it is practised from forms meaningless to the pupil?

Outline drawing from *flat examples* may be made both an interesting and intellectual exercise if managed in the following way, from objects which are real, known, and understood by the children.

Hang a calico kite upon the black-board by fastening it with a drawing pin. In Fig 1, ABCD represents a blackboard, X the real kite. This is placed on the right-hand side, so that the teacher will not stand in front of the object when making the sketch Y, which is to show the pupils how to set to work.

The teacher measures with a ruler the distance EF and rules a line 1J equal to it, that is, 32 inches long. The pupils are asked to rule a line the same length on their paper. They find they cannot. The teacher tells them to let a quartar of an inch in their drawing represent an inch of the kite. They rule a line as long as 32 quarter inches, that is, 8 inches long, to represent EF. The teacher measures the distance

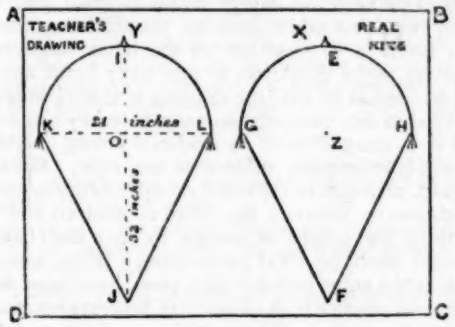


Fig. 1.

EZ, which is 11 inches, and marks point O. The children measure off 11 quarter inches to get point Z. The teacher measures GH, which is 21 inches, and marks 10½ inches on one side of O to get K, and 10½ on the other side of O to obtain point L. The children do the same, using a quarter of an inch for an inch. Nothing need be said about drawing to scale, although practice in it is thus given. The rulers are put on one side, and the children are asked to observe the curve GEH, without drawing it. The curve is then covered up with a duster or sheet of brown paper. When this is done, each pupil sketches the curve from memory in a corner of the paper. One or two trials, managed in the same way, will be necessary before the majority of the class will draw the curve well. This exercise trains the mind, through the eye, to be accurate in observing. When the pupils know the curve, they should be required to sketch it, beginning at G, passing through E and ending at H. The teacher, by sketching a line from K, through I to L, will show them the method of manipulation. It is well for the pupils to get the hand into a good position before drawing by sketching an imaginary line in the air, just over that portion of the paper where the real line is to be placed. The line from H to F should be drawn first by the teacher and then by the pupils. In the same way GF will be drawn. When the pupil has made a clean and careful sketch, do not allow it to be ruined by that stupid process named lining-in, which, in the vast majority of cases, means the spoiling of a fairly good drawing by the dragging over it of a hard, shaky, inartistic line. Skilful artisans or designers may find lining-in useful. It is not practised by artists, and is of no use to children, especially as it is not possible for them to do it even fairly well.

A great number of flat objects are suitable for copies from which to give practice of this kind—Japanese fans, painter's palettes, meat-hooks, hatchets, pair of tongs, scissors, large feathers (swan's quill), cricket-bat, wooden spoon, tennis racket, lacrosse racket, etc.

These copies should be placed at such a distance from the pupils, and in such a way, that the thickness, if there be any, will not be seen by them.

By making groups of the objects, two or more together, exercises of considerable difficulty may be obtained. Below are some examples:—

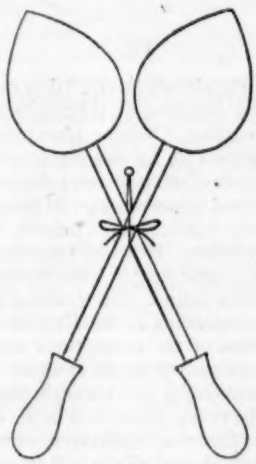


Fig. 2.

Fig. 2 shows two wooden spoons fastened together, and hung from a drawing-pin stuck in the blackboard.

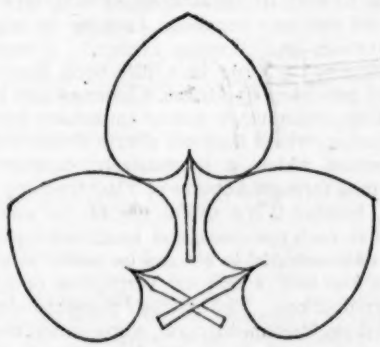


Fig. 3.

Fig. 3 shows a group of three palm-leaf fans, pinned on a blackboard to make a bi-symmetrical arrangement.

In Fig. 4 three painters' palettes are arranged in a group. To draw this group accurately requires considerable skill, and it is a much more difficult test than an ordinary balanced copy.

By this kind of drawing the pupil learns enough of drawing to scale to enable it to understand the maps in the geography lessons.

By drawing curves hidden from view the graphic memory is improved, and accurate observation becomes an absolute necessity. The pupils are obliged

to look well and intelligently, in order that the memory may retain that which is seen, in the form of *preserved*

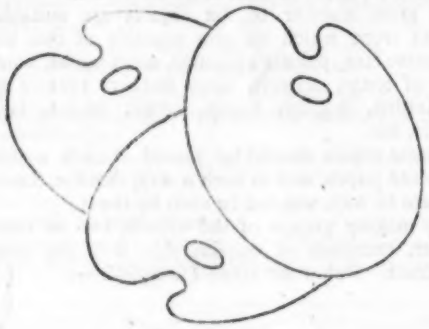


Fig. 4.

observation. People who think 'they can believe their eyes,' would be less firm in their belief if they had a little of this practice. Drawing from memory should be constantly resorted to, for the memory is brought into play in every act of drawing, and defective memory is the result of bad observation. Memory drawing developes a power which is most helpful in the acquirement of knowledge. Notably, the study of science is facilitated, and some people spell words more by their look than by their sound. The sound of a word, indeed, is often very misleading in the English language.

The acuteness of the perceptions may be increased if the eye be trained to judge, at sight, length, proportion, length compared with breadth, and angles. This training can be easily given to a large class by means of two simple pieces of apparatus, which I hope will soon be published, and which will supersede the rods, ruler, sliding shutter, and disc, hitherto employed in some schools for the purpose.

The outline drawing, which we term writing, may be made to work in advantageously with other drawing if the ordinary copybook exercise be alternated with exercises in "Written Design." Examples of this work may be found in a little book bearing that title, and published by Messrs. Chapman and Hall.

Shading.—Shading is a most important branch of art education, which does not always obtain that share of attention which it imperatively demands. All should pass through a course of class teaching in this subject, because it is a useful test of the amount of talent that each possesses, and because its principles can be demonstrated to all and be useful to all, even to those who lack a delicate perception of its more subtle graduations. The machine draughtsman, architectural draughtsman, engraver, wood-cutter, and many other art workers find a knowledge of the principles of light and shade very useful, and it is also very necessary to those who wish to make effective outline sketches.

Among skilled teachers, the stump is now generally accepted as the best instrument with which to teach the elementary principles. While recognising the value of the point in the hands of the skilled draughtsman, we should adopt the stump, as it will enable our pupils to learn quickly that which they have but a short time to study. We must teach the principles of shading from models and not from copies. The latter practice is as wasteful of time as to teach model drawing from printed examples, since theory is considered before facts have been acquired. For the collective teaching of the subject, the pupils must be arranged so that they may have approximately the same view of one object, well and strongly lighted. The teacher, having previously made a small sketch of it in light and shade, from a position near the centre of the class, will demonstrate, working on a large sheet of paper, the methods of procedure and the principles, being followed, step by step, by the pupils. Great pains must be taken to ensure a good method of manipulation. A large grey paper stump, as big as the thumb, and the stumping chalk known as Sauce Velours, should be used on the white paper named *Papier Ingres*. They can be obtained of Messrs. Lerchertier, Barbe & Co., 60, Regent Street, at a moderate cost. The stump should be pressed very lightly upon the paper in order that its grain may not be rubbed down. In good shading the chalk remains grey or black, but if it is rubbed or scrubbed into the paper, to the destruction of the grain, it turns brown. If the chalk is properly applied a piece of bread, worked between the fingers into a flattened ball, will easily wipe out white lines on the shaded surfaces. The bread is of great use in the latter stages of a drawing, when employed in this way; but it should not be used at all until the drawing is nearly complete. Bad habits in manipulation may be easily acquired, and it is more difficult to eradicate wrong methods than it is to implant those that are right. Suitable models, arranged in the order of their difficulty, must be chosen to illustrate the effect of contrast and reflections, and groups of models to show the changes brought about by aërial perspective. When models, such as the cube, cylinder and cone, have been dealt with, and practice in shading detail becomes necessary, large casts, such as the pumpkin, vegetable marrow, and ostriches' eggs afford good practice. The light should come from only one window, which should be blocked at the bottom, so that the rays will fall on the object at about an angle of 45°. The nearer the object is to the window the stronger the shadows will be, and the easier the shading.

The following rules will be found useful in regulating the execution of a shaded drawing:—

(1) Lay in the masses of shadow, being very careful to draw them well, dealing with the darkest first, the lightest next, and those of intermediate depth afterwards.

(2) Lay in the background of rather less than the right depth.

(3) Mark out the position of the highest light, and put in, of right depth, the deepest shadow.

(4) Obtain the graduations between the highest lights and the masses of the shadow.

(5) Put in the darker parts of the shadows.

(6) Graduate the background.

(7) Look carefully through the whole drawing, and work up the proper relations among the parts.

By this method, the extreme points of the scheme of light and shade are fixed as early as possible, and the depths are judged from them, and it will be impossible for a careful student to exhaust the deepest shade the chalk will give before putting in the darkest part of the drawing.

The teaching of shading is not at all difficult. I have known many students of moderate ability learn to make a fair shaded drawing from the cast, after a course of class lessons which took up altogether about forty hours.

(Conclusion.)

Query Column.

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

General.

1. PICKWICK.—The poet compares the majesty of heaven, rending the gnarled oak but sparing the tender plant, with the pride and impotence of man. 'Dressed in a little brief authority' is quite obvious. 'Most ignorant of what he's most assured, his glassy essence,' means 'Man is more certain of his consciousness, or spiritual nature, than anything else, and yet is profoundly ignorant of even that.' 'Glassy essence' is the inner life; spiritual nature comes nearest to it. The stupidity of the actions of a foolish man are compared with that of the freaks of an angry ape.

2. HARRY.—(1) The solution of your query appeared in our last issue. (2) Your writing is pretty fair, but it would be improved if it were a little larger.

3. CLARE.—(1) You will find the solution of your query in our issue for December, 1882. (2) Small hand perhaps 90 per cent.; text, 70 per cent.

4. D. GREIG.—Your query was solved in our issue for June, 1885.

5. ROOT.—In the quadratic equation :—

$$x^2+px+q=0,$$

$$x=\frac{-p\pm\sqrt{p^2-4q}}{2}.$$

Thus the root *must be* one or the other of two assigned expressions.

6. ROCHDALE.—The solution of your query appeared in our issue for June, 1885.

7. DESIROUS.—You will find the solution of your query in our issue for August, 1882.

8. BLACKBIRD.—You gave an incorrect address. A special letter was sent to you and returned to us through the post office.

9. PONTFAEN.—The small hand is good (85). The large hand is spoiled by the jagged edges of the letters. You don't hold your pen properly. 70. The other specimen is good (80).

10. J. CROW.—The examination lasts four days; you will perhaps have to be away from your home five days. Have an eye to letter-writing which includes punctuation.

11. OIL.—The best crystal (paraffin) burns without any smell if your lamp is perfectly clean and well-trimmed. The smell generally arises from some oil on the outside of the lamp.

12. LEHRER.—You will find full details as to the place and subjects by applying to the Registrar of the London University, Burlington Gardens, Piccadilly, W.C. A syllabus will be sent to you. You will find that you have two examinations to pass in order to obtain the degree. You may get some help in the way you suggest, but without efficient practical instruction in Biology and Chemistry, you will have small chance of success. Are there no science classes near you? Write to us again.

13. ANXIOUS ASSISTANT.—Put your name where it can be seen. No. 24 has no name attached to it. The 3s. 8d. edition referred to the Geography, and *Seeley* and *Abbott's* 'English for English people' was recommended as a help to English composition. Write to the Secretary of the college you mean to enter. He will be pleased to give you the information you ask for. We will only draw your attention to Dr. Maclear's excellent class book on the Catechism, the Rev. Canon Daniel's work on the Book of Common Prayer, and the Old and New Testament Commentary for schools, edited by Dr. Ellicott.

14. DEAR DAD.—The letters in the large hand are nearly all incorrectly formed; the same applies to those in the small hand. You should imitate some good copies. Large 60, small 65.

15. BONA-FIDE.—You seem to have imitated the writing from official letters. If your imitation is exact, the model was bad. Get some really good specimens of the style in question, and then practise diligently for some time. The small hand is best, 70; the other 55.

16. EDWARD.—An accurate balance is totally immersed in a vessel of water. In one scale pan some glass (sp. gr. 2·5) is being weighed, and exactly balances a one pound weight (sp. gr. 8·0) which is placed in the other scale pan. Find the real weight of the glass. (*University of London Matriculation*, 1875.)

The ratio of the weight of a body in vacuo to the weight of the volume of water it displaces at 4°C. is its specific gravity. The weight of water displaced by the pound weight is two ounces. The downward pressure is therefore 14 oz.: as glass loses $\frac{1}{2\frac{1}{2}}$ of its weight when immersed in water, we want to find the amount of glass which, when it has lost $\frac{1}{2\frac{1}{2}}$ of its weight will be 14 oz. Let it be x ounces :—

$$\text{Then } x-\frac{1}{2\frac{1}{2}}x=14$$

$$\text{whence } 3x=70$$

$$x=23\tfrac{1}{3}=1\text{ lb. }7\tfrac{1}{3}\text{ oz.}$$

17. BLÆNAVOD.—Small hand is moderate, 60; text hand is poor, 50. The large hand is a little better, 55. The shape of the letters is not a matter of taste. There are recognised forms; and these must be followed. Yours are original.

18. HOPEFUL.—We can only offer opinions. It is impossible without knowing more about you to tell you exactly what to do. Judging from your letters we should think it would take you quite two years to prepare yourself for the entrance examination. We do think the sort of school you name is very likely to suit your requirements. We really cannot say. The offer is not very tempting, unless (1) the work is light, (2) the opportunities for improvement considerable, (3) good instruction afforded you. Try *Hall's* 'Algebra' (Macmillan and Co.). Don't begin Physiology yet. You can, however, read the primers on Botany and Physiology (Macmillan). Remember, however, that reading about these things is of little use: you must examine them for yourself.

19. SELF-TAUGHT.—We can quite understand your difficulties. 'Cæsar, Book I.' is a most unfit introduction to Latin prose. It is much too difficult. You would do infinitely better to get Smith's Part II., which is a reading book and vocabulary in one. Go through half of that, and then turn to 'Cæsar' again. The Principia Part I. scarcely contains enough; could you not add *Dr. Abbott's* 'Via Latina' to your list? You will find that a translation can rarely be literal. Get the exact equivalent for the Latin, and be sure your translation is expressed in good English.

20. STUDENT.—We are glad you read the Pupil Teachers' paper for November. Those who took the third year's papers last March will have fifteen months to prepare themselves for the Scholarship Examination. Those who took the third year's

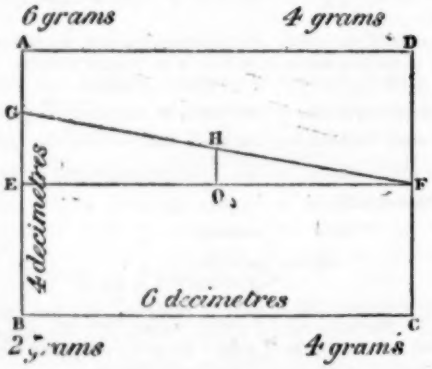
papers in October will have about eight months; hence they will be at a slight disadvantage. A cyclopædia is scarcely a book to buy. Could you not get one out of a library? The idea was to enlarge a pupil teacher's store of general knowledge. The practical exercise is compulsory, but not of great value. You may hope for a good place.

21. T. S. VINCENT.—The items you name are only a very few taken from the syllabus of experimental physics. You will find all you ask and, indeed, all you want, in *Deschanel's* 'Natural Philosophy,' last edition. There are plenty of excellent examples for practice at the end of the volume. It is published in four parts. *Ganôt's* 'Physics' would also cover the course. If you have the facilities for doing any practical work, by all means avail yourself of it. A book like *Worthington's* 'Practical Physics,' reviewed in this month's PRACTICAL TEACHER, would be a great help to you.

22. IPSWICHIAN.—You can be examined for blackboard at any Training College, by giving due notice to the secretary hat you wish to attend. You cannot prepare yourself by reading a book. In your case there should no: be any difficulty. Have you noticed the articles on the principles of drawing now passing through this magazine? The examination in blackboard is at present conducted in this way. A few common articles, such as a saucepan, a kettle, a tea-pot, are placed before you. You are requested to make a small sketch of one of them on paper; then you have to make a large drawing of it on a blackboard.

23. BUCKLEY.—We should think it means any one of the five. We advise you strongly not to seek for any 'authority.' Write to your inspector if you cannot see him or his assistant. Ascertain his wishes and try and meet them.

24. OLD SUBSCRIBER.—Weights as per diagram are suspended from a rectangle whose weight is neglected. It is required to know the distance of the centre of gravity of the whole system, from the centre of the rectangle.



Let G be the centre of gravity of the weights at A and B;
Then, 6 grams : 2 grams :: GB : GA,
6 grams + 2 grams : 2 grams :: GB + GA : GA,
8 grams : 2 grams :: AB : GA,
4 : 1 :: 4 Decimetres : GA,
∴ GA = 1 Decimetre.

The centre of gravity of the weights at C and D will be F, the middle point of CD.

The centre of gravity of the weights at G and F is the middle point of GF, as the weights are equal, viz., 8 grams.

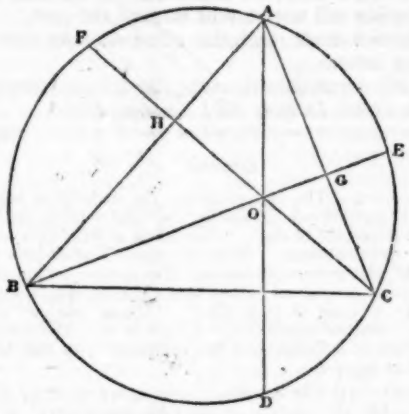
$GF^2 = EF^2 + EG^2$, (I. 47.)
∴ $GF = \sqrt{6^2 + 1^2}$ Decimetres
$= \sqrt{37}$ Decimetres;
∴ $FH = \frac{\sqrt{37}}{2}$ Decimetres.

The middle point of EF is the centre of the rectangle.
As FH = ½FG,
And FO = ½FE.
∴ HO is parallel to GE, and it is therefore the distance of the centre of gravity of the whole system from the centre of the rectangle;

$HO^2 = FH^2 - FO^2$,
∴ $HO = \sqrt{\left(\frac{\sqrt{37}}{2}\right)^2 - 3^2}$ Decimetre
$= \sqrt{\frac{37}{4} - 9}$ Decimetre
$= \sqrt{\frac{1}{4}}$ Decimetre
$= \frac{1}{2}$ Decimetre. Ans.

Geometry.

1. ARTHUR.—ABC is a triangle inscribed in a circle; perpendiculars are let fall from the angular points A, B, C to the opposite sides of the triangle, and are produced, if necessary, to meet the circumference in D, E, and F. Show that the arcs EF, FD, DE are bisected in A, B, and C. (*Science Examination*, 1884.)



Proof.—In the triangles BOH, COG,
∠BHO = ∠CGO, (Ax. 11.)
and ∠BOH = ∠COG, (I. 15.)
∴ ∠OBH = ∠OCG; (I. 32.)

And because the angles ABE, ACF, at the circumference, are equal,

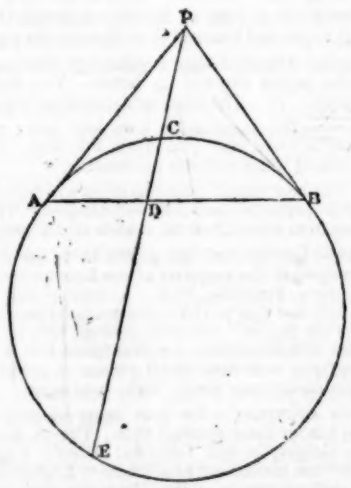
∴ arc AE = arc AF;

(III. 26. In equal circles, equal angles at the circumferences stand on equal arcs.)

Wherefore the arc EF is bisected in A.

Similarly it can be proved that the arcs FD, DE are bisected in B, C. Q. E. D.

2. D. ANGUS.—If the points of contact of two tangents to a circle be joined, any secant drawn from their intersection is divided into three segments, such that the rectangle under the secant and its middle segment is equal to that under its extreme segments.



Let PA, PB be tangents from the point P to the circle AEBC; and let AB be the line joining the points of contact; also let PCDE be any secant from the point P.

Then the rectangle PE.CD shall be equal to the rectangle PC.DE.

Proof.—Because △ APB is isosceles,

$\therefore AP^2 = PD^2 + AD.DB$;

But $AP^2 = PE.PC$, (III. 36.)

And $AD.DB = CD.DE$, (III. 35.)

$\therefore PE.PC = PD^2 + CD.DE$

$= PD.PC + PD.CD + CD.DE$ (II. 2.)

$= PD.PC + (PD + DE).CD$

$= PD.PC + PE.CD$;

But $PE.PC = PD.PC + DE.PC$;

$\therefore PD.PC + DE.PC = PD.PC + PE.CD$,

Wherefore $PE.CD = PC.DE$. (Ax. 3.) Q.E.D.

Arithmetic.

1. INQUIRER.—A plot of land containing 14 ac. 3 ro. is divided into 36 larger and 64 smaller allotments, 2 of the former being equal to 3 of the latter; find the size of the lots. (*Bangor University College*, 1885.)

Size of smaller allotments $= 14$ ac. 3 ro. $\div \{(\frac{3}{8} \times 3) + 64\}$
$= 14$ ac. 3 ro. $\div (54 + 64)$
$= 59$ ro. $\div 118$
$= \frac{1}{2}$ ro.
$= 20$ po.;

Size of larger allotments $= 20$ po. $\times \frac{3}{2}$
$= \underline{30 \text{ po.}}$

2. NEGOMBO.—Two vessels are seen to double a point at the interval of 5 days, travelling at the rates of 50 and 80 miles respectively a day. The faster of the two vessels reaches the destination, turns back, and sailing with its speed altered, meets the other vessel 10 days after doubling the point at $22\frac{3}{8}$ miles from the destination; find the altered rate of the vessel.

Distance from point to destination
$= \{50 \text{ miles} \times (5 + 10)\} + 22\frac{3}{8}$ miles
$= 750$ miles $+ 22\frac{3}{8}$ miles
$= 772\frac{3}{8}$ miles;

Time for the faster vessel to reach destination after doubling the point
$= (772\frac{3}{8} \div 80)$ days
$= 9\frac{52\frac{3}{8}}{80}$ days
$= 9\frac{7}{10}$ days;

$\therefore$ Altered daily rate $= 22\frac{3}{8}$ miles $\div (10 - 9\frac{7}{10})$
$= 22\frac{3}{8}$ miles $\div \frac{3}{10}$
$= \left(\frac{179}{8} \times \frac{7}{3}\right)$ miles
$= \underline{64 \text{ miles.}}$ Ans.

3. JUNIOR.—Two men are walking in the same direction along a railway line. A train, travelling at the rate of forty miles an hour, overtakes the first man, who is walking at the rate of 4 miles an hour, and passes him in $7\frac{1}{2}$ seconds. In $6\frac{3}{4}$ minutes after it passes the first man it overtakes the second, and passes him in $7\frac{1}{2}$ seconds. In how many hours will the first man overtake the second? (*Civil Service Examination*, 1885.)

$$\frac{\text{Length of train in yds.}}{(40-4) \text{ miles}} = \frac{7\frac{1}{2} \text{ sec.}}{1 \text{ hour}},$$

$$\frac{\text{Length of train in yds.}}{36 \times 1760} = \frac{15}{\frac{3600 \times 2}{240}},$$

$$\therefore \text{Length of train} = \frac{\overset{3}{36} \times 15 \overset{44}{6}0}{\underset{4}{240}} \text{ yds.}$$

$$= \underline{132 \text{ yds.}}$$

$$\frac{132 \text{ yds.}}{(40 - \text{Rate of second man}) \text{ miles}} = \frac{7\frac{1}{2} \text{ sec.}}{1 \text{ hour}},$$

$$\frac{\overset{3}{132}}{(40 - \text{Rate of second man in miles}) \times \underset{40}{1760}} = \frac{19}{\frac{3600}{1200} \times 8},$$

$3 \times 1200 \times 8 = 40 \times 19\ (40 - \text{Rate of second man in miles})$,

$3 \times 30 \times 8 = 19\ (40 - \text{Rate of second man in miles})$,

$\frac{720}{19} = 40 - \text{Rate of second man in miles}$,

$\therefore$ Rate of second man per hour $= (40 - \frac{720}{19})$ miles
$= (40 - 37\frac{17}{19})$ miles
$= \underline{2\frac{2}{19} \text{ miles.}}$

Distance between the two men when the train overtakes the first man

$= (40 - 2\frac{2}{19})$ miles $\times \frac{6\frac{3}{4} \text{min.} + 7\frac{1}{2} \text{ sec.}}{1 \text{ hour}}$

$= 37\frac{17}{19}$ miles $\times \frac{6\frac{3}{4} + \frac{1}{2}}{60}$

$= \left(\frac{720}{19} \times \frac{7\frac{1}{4}}{60}\right)$ miles

$= \left(\frac{\overset{3}{720}}{19} \times \frac{55}{\underset{2}{460}}\right)$ miles

$= \frac{330}{38}$ miles;

$\therefore$ Time for first man to overtake the second after train reaches the first man
$= \{\frac{330}{38} \div (4 - 2\frac{2}{19})\}$ hours
$= (\frac{330}{38} \div 1\frac{17}{19})$ hours
$= \left(\frac{\overset{55}{330}}{38} \times \frac{19}{\underset{12}{38}}\right)$ hours
$= \frac{11}{4}$ hours
$= 2\frac{3}{4}$ hours
$= \underline{2 \text{ hrs. } 17\frac{1}{2} \text{ m'n.}}$ Ans.

4. LIBERAL.—Two persons set out to walk from A to B; the first walks 4 miles an hour, and in 45 minutes he is $\frac{3}{4}$ mile before the other; he then stops $\frac{1}{2}$ hour, and afterwards proceeds at the same rate as before, and in the end arrives $\frac{1}{2}$ hour before the other, who has travelled at a uniform pace all the way without stopping. Required the distance from A to B.

Distance walked by second person in 45 min.
$= \frac{3}{4}$ of 4 miles $- \frac{3}{4}$ mile
$= 3$ miles $- \frac{3}{4}$ mile
$= 2\frac{1}{4}$ miles;

$\therefore$ Second person's rate per hour $= 2\frac{1}{4}$ miles $\times \frac{4}{3}$
$= \left(\frac{\overset{7}{9}}{4} \times \frac{\overset{1}{4}}{3}\right)$ miles
$= 3$ miles;

First person gains $\frac{1}{2}$ mile per hour;

Total distance gained $= 3\frac{1}{2}$ miles $\times (\frac{1}{6} + \frac{1}{2})$
$= 3\frac{1}{2}$ miles;

First person gains this distance in ($3\frac{1}{2}$ miles $\div \frac{1}{2}$ mile) hours
$= 7$ hours;

$\therefore$ Distance from A to B $= 4$ miles $\times 7$
$= \underline{28 \text{ miles.}}$ Ans.

5. JUNIOR.—Three clocks, A, B, and C, are going at a uniform speed. A at noon on Monday is a minute too slow, B is 2 minutes slow, and C is 1 minute fast. At 8 p.m. on Tuesday B is 3 minutes fast, and C is one minute slow. At 8 a.m. on Wednesday A is $2\frac{3}{4}$ minutes before B. Find when A and C will indicate the same time. (*Civil Service Examination*).

Time from noon on Monday to 8 p.m. on Tuesday $= 32$ hours;
" " " 8 a.m. on Wednesday $= 44$ hours;

$\therefore$ B gains 5 min. in 32 hours;
C loses 2 " " " ;

Time gained by B in 44 hours $= 5$ min. $\times \frac{11}{4}$
$= 5$ min. $\times \frac{11}{4}$
$= 6\frac{7}{8}$ min.;

" lost " C " $= 2$ min. $\times \frac{11}{8}$
$= 2\frac{3}{4}$ min.;

$\therefore$ At 8 a.m. on Wednesday A is ($6\frac{7}{8}$ min. $- 2$ min. $+ 2\frac{3}{4}$ min.) fast
$= 7\frac{1}{8}$ min. fast;

" " C is ($2\frac{3}{4}$ min. $- 1$ min.) slow
$= 1\frac{3}{4}$ min. slow;

A gains ($7\frac{1}{8}$ min. $+ 1$ min.) in 44 hours,

$\therefore$ A's daily gain $= 8\frac{1}{8}$ min. $\div 4\frac{2}{3}$
$= \left(\frac{\overset{3}{65}}{8} \times \frac{3}{\underset{2}{14}}\right)$ min.
$= 4\frac{1}{2}$ min.;

C loses 2 min. in 32 hours,

$\therefore$ C's daily loss $= 2$ min. $\div 4\frac{2}{3}$
$= \frac{2 \times 3}{4}$ min.
$= 1\frac{1}{2}$ min.;

Daily difference $= 4\frac{1}{2}$ min. $+ 1\frac{1}{2}$ min.
$= 6$ min. ;
∴ There will be a difference of 1 hour in
$$\frac{60 \text{ min.} - (7\frac{1}{2} \text{ min.} + 1\frac{1}{2} \text{ min.})}{6 \text{ min.}} \text{ days}$$
$= \frac{8}{9}$ days
$= 8\frac{1}{2}$ days ;
∴ At 8 p.m. on Thursday week there is an hour's difference between A and C. ;
There will be another hour's difference in
$$\frac{60 \text{ min.}}{6 \text{ min.}} \text{ days}$$
$= 10$ days ;
∴ There will be 12 hours' difference in (10×11) days
$= 110$ days
$= 15$ weeks 5 days ;
∴ A and C will indicate the same time at 8 p.m. on Tuesday, 17 weeks after the first Tuesday.

Algebra.

1. ANXIOUS.—A man invests £14,970 in the purchase of 3 per cents. at 90, and of $3\frac{1}{2}$ per cents. at 97. His total income being £500, how much did he invest in each stock? (*Hamblin Smith.*)

Let x = Amount invested in pounds in 3% stock,
Then $14{,}970 - x =$ " " " " $3\frac{1}{2}$% " ;
$$\therefore \frac{x \times 3}{90} + \frac{(14{,}970 - x) \times 3\frac{1}{2}}{97} = 500$$
$$\frac{x}{30} + \frac{13(14{,}970 - x)}{388} = 500$$
$$194x + 195(14{,}970 - x) = 2{,}910{,}000$$
$$194x + 2{,}919{,}150 - 195x = 2{,}910{,}000$$
$$194x - 195x = 2{,}910{,}000 - 2{,}919{,}150$$
$$\therefore x = \underline{9{,}150}.$$

∴ Amount invested in 3 per cents. at 90 = £9150 ;
" " $3\frac{1}{2}$ " " 97 = £14,970 − £9150
= £5820.

2. FOLKESTONIAN.—The cost of levelling a square exercise ground is £70, and if each side were three feet longer, the cost would be increased by £7 3s. 6d. What is the length of the side of the square, and the cost per square yard?

Let x = Length of side of square in yards,
Then $\frac{£70}{x^2}$ = Cost per sq. yd.,
And $\frac{£77\ 3s.\ 6d.}{(x+1)^2}$ = " " ;
$$\therefore \frac{1543\frac{1}{2}}{(x+1)^2} = \frac{1400}{x^2}$$
$$\frac{3087}{x^2 + 2x + 1} = \frac{2800}{x^2}$$
$$\frac{441}{x^2 + 2x + 1} = \frac{400}{x^2}$$
$$441x^2 = 400x^2 + 800x + 400$$
$$41x^2 - 800x = 400$$
$$x^2 - \frac{800x}{41} = \frac{400}{41}$$
$$x^2 - \frac{800x}{41} + (\tfrac{400}{41})^2 = \frac{400}{41} + \tfrac{160000}{1681}$$
$$= \frac{16400 + 160000}{1681}$$
$$= 1\tfrac{176400}{1681}$$
$$x - \tfrac{400}{41} = \pm \tfrac{420}{41}$$
$$x = \pm \tfrac{420}{41} + \tfrac{400}{41}$$
$$\therefore x = \underline{20, \text{ or, } -\tfrac{20}{41}}.$$

∴ Length of side of square = 20 yds. ;
Cost per square yard $= \frac{£70}{400}$
$= £\frac{7}{40}$
$= \underline{3s.\ 6d.}$

3. P. P.—How much should be paid for an annuity of £250 to last for 9 years, reckoning compound interest at 4 per cent.? Express the answer in pounds and decimals of a pound.

Log. 1·04 = ·0170333,
Log. 7·02587 = ·8467003.
(*Intermediate Arts*, 1885.)

Let A denote the annuity in pounds, n the number of years, R the amount of one pound in one year, and P the present value of the annuity in pounds ; then,
$$PR^n = \frac{R^n - 1}{R - 1} A ;$$
$$\therefore P(1{\cdot}04)^9 = \frac{(1{\cdot}04)^9 - 1}{1{\cdot}04 - 1} \times 250,$$
$$\left\{ \begin{array}{l} \log.\ (1{\cdot}04)^9 = \log.\ 1{\cdot}04 \times 9 \\ \quad = {\cdot}0170333 \times 9 \\ \quad = {\cdot}1532997 \\ \quad = 1 - {\cdot}8467003 \\ \quad = \log.\ 10 \div \log.\ 7{\cdot}02587 \\ \therefore (1{\cdot}04)^9 = \dfrac{10}{7{\cdot}02587} \end{array} \right.$$
$$P \times \frac{10}{7{\cdot}02587} = \frac{\frac{10}{7{\cdot}02587} - 1}{04} \times 250$$
$$= \frac{2{\cdot}97413 \times 25}{7{\cdot}02587} \times 250,$$
$$P \times 10 = 2{\cdot}97413 \times 25 \times 250,$$
$$\therefore P = 2{\cdot}97413 \times 625$$
$$= \frac{29741{\cdot}3}{16}$$
$$= \underline{1858{\cdot}83125}.$$
∴ Amount to be paid = £1858 83125.

Mensuration.

1. JAMES.—A room 25 feet long and 15 feet wide is covered with paper 30 inches wide at 9d. per yard; if the paper had been 33 inches wide, the cost would have been 14s. 8d. less. Find the height of the room.
$$\left\{ \frac{2(25+15) \times \text{Height in ft.}}{9} \times (\tfrac{30}{36} - \tfrac{30}{33}) \times 9 \right\} \text{d.}$$
$$= 14\text{s. } 8\text{d.},$$
$$80 \times \text{Height in ft.} \times (\tfrac{1}{2}\tfrac{1}{0} - \tfrac{1}{1}\tfrac{1}{1}) = 176,$$
$$80 \times \text{Height in ft.} \times \frac{132 - 120}{110} = 176,$$
$$\text{Height in ft.} \times \frac{80 \times 12}{110} = 176,$$
$$\therefore \text{Height} = \left(176 \times \frac{11}{96} \right) \text{ft.}$$
$$= 20\tfrac{4}{8} \text{ ft.}$$
$$= 20\tfrac{1}{2} \text{ ft.}$$
$$= \underline{20 \text{ ft. } 2 \text{ in.}} \text{ Ans.}$$

Note.—Your writing is only moderate. It is too pointed.

2. CANDIDATE.—A certain room is one-third as wide, and one-half as high, as it is long. One-twelfth of the wall space is taken up by windows and a fireplace. If the cost per square foot of painting the walls and ceiling be one-fourth the cost per square foot of carpeting the floor with carpet 2 ft. 3 in. wide at 3s. 4½d. per yard, find the length of the room, the entire cost being £52 13s. (*Lower Division*, October, 1885.)

Cost of carpeting per sq. ft. = 3s. $4\frac{1}{2}$d. $\div (2\frac{1}{4} \times 3)$
$$= 40\tfrac{1}{2}\text{d.} \div 6\tfrac{3}{4}$$
$$= \left(\frac{81}{2} \times \frac{4}{27} \right) \text{d.}$$
$$= 6\text{d.}$$

Let L stand for length of room in ft. ;
Then,
$$6\text{d.} \times [(L \times \tfrac{1}{3} L) + \tfrac{1}{2}\{(L + \tfrac{1}{3} L) \times 2 \times \tfrac{1}{3} L \times \tfrac{11}{12}\} + \tfrac{1}{4}(L \times \tfrac{1}{3} L)]$$
$$= £52\ 13\text{s.},$$
$$\tfrac{1}{3} L^2 + \left(\frac{1}{8} \times \frac{4}{3} \times \frac{11}{12} L^2 \right) + (\tfrac{1}{4} \times \tfrac{1}{3} L^2)$$
$$= \frac{1053\text{s.}}{6\text{d.}},$$
$$\tfrac{1}{3} L^2 + \tfrac{1}{9} L^2 + \tfrac{1}{18} L^2 = 2106,$$
$$\frac{12 + 11 + 3}{36} L^2 = 2106,$$
$$\tfrac{26}{36} L^2 = 2106,$$
$$L^2 = 2105 \times \tfrac{1}{2}\tfrac{6}{5}$$
$$= 2916.$$
$$\therefore L = \sqrt{2916}$$
$$= \underline{54}.$$

∴ Length of room = 54 ft.
$= \underline{18 \text{ yds.}}$ Ans

Exhibition of Appliances used in Geographical Education.

AMONGST the attractions of the season for teachers who stay in London during the Christmas vacation, the Geographical Exhibition recently opened at 53, Gt. Marlborough Street, W., will occupy a commanding place. A visit to Mr. Keltie's well-furnished 'gallery of illustrations' will prove both recreative and educative. The Exhibition is reached by passing through Argyle Place, on the east of Regent Street.

PRINCIPLES OF SELECTION.

The leading principles, which appear to have guided the director in the selection and arrangement of his *matériel*, are the following :—

1. **Appliances which aim at teaching geography successfully must exhibit the related phenomena—mountains, valleys, rivers, etc.—in their natural and scientific grouping.**
2. **That the details of any district under review should be selected and arranged on a scale such that an entire group of allied geographical phenomena may be seen simultaneously in their true connections.**
3. **That the imagination of the learner should be stimulated by the symmetry and beauty of the illustration, at the same time the identification of causes and effects, which the appliances are intended to assist, should be both an exercise and a training of the reasoning powers.**

MIDDLE-CLASS AND ELEMENTARY SCHOOLS COMPARED.

Mr. Scott Keltie limited his inquiry, so far as England is concerned, mainly to the teaching of geography in middle-class and high schools. He states: 'That in these schools the appliances are bad, and as for method there is none. In the elementary schools both method and appliances have greatly improved, along with the improved position of the subject.' If Mr. Keltie had found time to visit more of the elementary schools of this country, he would have found many of the appliances which are in *ordinary* use in similar schools on the Continent—sand models; plaster casts; the model of the surrounding district carved on the playground terrace; simple apparatus for illustrating movements of the heavenly bodies, which are on too grand a scale for direct observation; all these are in use in our elementary schools, and with the most satisfactory results.

TEXT-BOOKS: A SEVERE CRITICISM.

The judgment passed on the English text-books in use is very severe. They are 'simply appeals to memory; they are handbooks of mnemonics, but they are in no sense handbooks of geography.' This criticism is sweeping. Is it just? In reply, let us take any of the approved manuals of geography, and select that portion dealing with the drainage and river system of a district. The rivers of England will be arranged most probably according to the side of England they happen to drain. Now, to teach a child to associate the Tees, or the Trent, with the Yorkshire Ouse is fatal to an intelligent appreciation of the geographical truths which should be connected with the river Ouse. The mountains in the west; the gradual slope south-eastward to the sea; the corrugation of this slope into dale and moorland, each dale having its own watercourse, and, finally, the spreading vale of York with its main stream; these are the truths of physical and descriptive geography, which naturally group themselves round the river Ouse. In so far, then, as our text-books do not attempt to associate geographical facts in their natural grouping they are faulty. On the other hand, a careful perusal of many of the geographical reading-books which have been published of late years in this country, will satisfy the unbiassed critic that we are not one whit behind the foremost of continental states in this form of literature.

THE RELIEF MODEL: ITS VALUE AND LIMITATION.

The apparatus helpful for teaching the facts of physical and descriptive geography in their natural and scientific grouping are the RELIEF MODEL, and maps shaded so as to yield the same effects as the model. Of these there are excellent specimens in the collection at Gt. Marlborough Street. Immediately upon entrance, a relief model of the Monte Rosa and Matterhorn area fixes the attention of the visitor. It is a magnificent work. The vertical and horizontal scales are equal, and the whole is tinted according to nature. By the aid of this model the entire sculpturing of the Alpine plateau by glacier and mountain torrent is readily realised, and realised, too, under conditions of awakened interest, which makes the effort delightful, and the mental results both valuable and lasting. A model of this excellence serves an educational purpose helpful even to actual travel and direct contact with Alpine scenery; for it exhibits a grouping of phenomena on such a scale that they can be simultaneously seen in their natural relations, whereas in nature one feature—a mountain mass, for example—frequently fills the entire view.

In contrast with this work of art from the Polytechnic at Zurich are some models constructed for English schools. These are crude, no doubt, but it should be remembered that the Monte Rosa model is valued at eighty pounds, and is found only in the Polytechnic of a state which spends one-fourth of its entire taxes in education. The ordinary English school will remain content with the methods of map-reading adopted in the common schools of Germany. The method has been in modest use for four or five years in many of our schools.

Mr. Keltie says :—

> 'In Germany the use of sand to build up the features of a district is generally in vogue. In the first Realschule of Leipzig, for example, the staff map of a district is used, and the pupil made to build a sand relief with careful regard to the contour lines. Another method of teaching the significance of cartographic symbols I found in a secondary school in Zurich, in a class the pupils of which were about twelve years of age. Taking the carefully-drawn maps for the purpose in the beginning of Wettstein's fine school atlas, the pupils are made to cut out pieces of cardboard for the different levels, and so build up a relief, which enables them to realise what the symbols signify. As the contour lines are combined with carefully-graduated mountain shading, the pupils thus come to learn the significance of the customary map-symbols. Specimens of these reliefs will be found in the Exhibition.

'There is no doubt that the judicious use of good reliefs along with corresponding maps is a very effective method of teaching the pupil to interpret maps. On the table is a relief of a particular region limited enough to avoid exaggeration of altitudes; and above this are corresponding maps on various scales, with various methods of representing altitudes.'

There are some English relief models in the Exhibition by Jordan, which are excellent specimens of modelling and contouring. One is a relief model of the Thames Basin, the surface of which is tinted geologically; the other illustrates the sea floor round the British Isles. The latter is a specimen of contouring by means of successive layers of cardboard, and is a most effective appliance for teaching purposes. This form of model may be made for any locality of which a contour map is constructed.

The relief models of large areas, such as countries and continents (of which the Exhibition contains several) are not so well adapted for teaching purposes as those already mentioned. They either exaggerate the vertical scale too much, and thus give false impressions, or else if the true proportions between the vertical and horizontal are kept, a confused mass of convolutions is the result, which fails to produce any distinct and lasting ideas.

FOREIGN AND ENGLISH MAPS COMPARED.

Maps are far more abundant than models. There are specimens from most of our continental neighbours. When we compare the foreign with many of our English maps, we at once see the influence the model has had upon the work of the foreign chartographer. Our English map—with a few notable exceptions, especially those of Murby and Stanford—has a dull and flat appearance. It is almost purely symbolic and plan-like, whereas the German, the French, and the Swiss maps, by a system of shading reproduce all the effects of the model, and in some cases with remarkable success. They supply elevation as well as plan. They are pictorial rather than symbolic.

'The maps are arranged on the walls in geographical order, beginning with maps of the World, followed by Europe and parts of Europe, Asia, etc. The object aimed at has been to hang side by side specimens of the work of different publishers and different countries, so that visitors can compare the styles for themselves. The specimens exhibited will be found to be of all gradations of quality; in all classes will be found objects which may be taken as examples of "how not to do it."'

MISCELLANEOUS APPLIANCES

The TELLURIA are not numerous. Some of these are both complicated and expensive. A simple and effective form is No. 264, by Schotte and Co., sold by Geo. Philip and Son. PICTURESQUE GEOGRAPHY is well represented by several series of chromos and lithos, many of which have already found their way into English schools.

'There is a very extensive collection of geographical text-books and atlases. The latter excel chiefly in the arrangement of matter, in the character of the hill-shading, and in the taste displayed in the colouring.'

CONCLUSIONS.

Two of these force themselves upon the teacher after a thorough inspection of this interesting collection.

1. The foreign appliances have risen to the height of the conception these respective peoples have formed of what constitutes a fruitful study of geography. They see in geography a grouping of naturally related phenomena, which, when the relations are recognised, yields the best geographical information, and during the process of acquisition affords high intellectual training. The English teaching and appliances will rise to as high a level under the stimulus of a free syllabus and intelligent examination.

2. We must be careful to leave something to the ingenuity and intelligence of the learner. Map-reading is vastly aided by relief models, contour-strata reliefs, and maps beautifully shaded. These will, however, all need to rest for their full effect on a basis of experience. Only after a scholar has had the opportunity of taking his directions in the field, and of mapping from his own observation the various features of a well-known area, will he have that enthusiasm which will enable him to effect an intelligent mastery of this delightful school study.

JOS. H. COWHAM.

Publications Received.

Bell (G.) and Son—
The Definitions of Euclid. By R. Webb, M.A.

Blackie and Son—
The Stanhope Arithmetical Test Cards. Standards III. to VII.
Blackie's School Classics:—
Richard II. and Henry IV. Part. II.
Henry VIII. and Julius Cæsar.
An Elementary Treatise on Physical Geography.
The English Language and Literature.
Blackie's Drawing Series:—
Drawing Copies. Standards I. and II. (Elementary and Advanced).
" " III. (Freehand).
" " III. (Geometrical).
Ruled Exercise Books for the Standards.
The Scholar's Slate Card. Standards I. and II.
The Teacher's Slate Card. Standards I. and II.
Demonstration Sheets. Standards I. and II. (Elementary).
" " (Advanced).
Standard III. (Freehand).
" III. (Geometrical).
Vere Foster's Copy Books. Nos. 1 and 2. New Series.

Hodder and Stoughton—
Poor Boys who became Famous. By S. K. Bolton.

Johnston (W. and A. K.)—
Map of Australia, with Handbook.

Kegan Paul and Co.—
An Epitome of English Grammar. By W. H. H. Kelke, M.A.

Letts, Son, and Co., Limited—
Letts's Illustrated Household Magazine. December.

Longmans and Co.—
Longman's Magazine, January.
Longmans' New Readers: Primers I. and II.; Infants, I., II., and III.
The Seasons Pictured. By R. A Procter.

Murby, T.—
The Acme Drawing Cards. Sets 'E.' and 'F.'
Murby's Memory Work:—Sketch Maps.

Norgate (F.)—
Ahn's French Method. By G. A. Neven.
Bucheim's French Reader.
Modern Plays for Schools (Deutsches Theater). By Dr. C. A. Bucheim.
Declension of the German Substantive.

Swan Sonnenschein and Co.—
The Truth about Elementary Education. By A. Sonnenschein.
Student's Manual of the Reign of George II.

Plain Needlework and Knitting. By Helen K. Brietzcke and Emily F. Rooper.
Overpressure and Elementary Education. By Sydney Buxton, M.P.
Select Poems of Goethe. By Professors Sonnenschein and Pogatscher.

Smith, Elder, and Co.—
The Cornhill Magazine. December.

Wesleyan Methodist Sunday School Union (The)—
Eleanor's Ambition.
The Archer's Chance Shot. } By Sarson C. J. Ingham.
Waiting.
The Junior and Senior Scholar's Tablet Books.
Our Boys and Girls. Vol. 1885.

The 'Practical Teacher' Sale and Exchange Column.

Owing to numerous requests, we have been induced to start this Exchange Column for the benefit of our readers. We shall be glad to insert announcements relating to the 'Sale or Exchange' of books, etc., at the rate of ONE PENNY PER LINE, *prepaid.*

Wanted:—Vol. IV., No. 12, Feb., 1885, PRACTICAL TEACHER. 1s. offered.—W. T. Scott, Welton School, near Lincoln.

Offers wanted for:—Boy's Own Paper, Vols. I. to VI., bound; PRACTICAL TEACHER, Vols. I. to IV., bound; Cassell's Family Paper, 4 double vols., old series; Argosy, 12 double volumes, 1874 to 1885; 6 of Mrs. H. Wood's 6s. novels, East Lynne, etc.—Address, Schoolmaster, Ofiham, West Malling, Maidstone.

Wanted:—Latest editions of Richardson's 5s. Geography (edited by Dr. W. Smith), and The Student's Hume. State lowest price, carriage paid.—Master, Foston School, York.

For disposal at half-price (cash), good condition:—24 Nos. of Cassell's Family Magazine, 1883-84; 12 Nos. of Good Words for 1877; 12 Nos. of Leisure Hour for 1885; Chambers's Journal, 1884-85; also magic lantern, works from any gas-burner, with tube supplied. 27 movable slides (double).—Address, Head Master, National School, Harwich.

For sale or exchange for chemical apparatus, etc., or Science Text-books:—Jacob's Greek Grammar (2s.) for 1s.; Schmitz's Latin (2s. 6d.) for 1s. 3d.; Smith's French Principia, Part I. (3s. 6d.) for 2s.; Orme's Heat (3s. 6d.) for 2s.; White's English Latin Dictionary (5s. 6d.) for 3s.; Virgil's Æneid, Book VI. (1s.) for 6d.; Buckmaster's Principles of Agriculture, (1s. 6d.) for 9d., all new; THE PRACTICAL TEACHER, Vol. I., 4s.; Gill's School Management (3s.) for 1s. 3d.; Cornwell's Geography (3s. 6d.) for 1s.; Lawson's Geography of River Systems (1s.) for 6d.; Todhunter's Algebra, small, 1s. 9d.; Morrell's Grammar and Analysis, 1s., free.—Master, Whissonsett Board School, East Dereham.

Publications Reviewed.

A Concise Dictionary of the English Language, Literary, Scientific, Etymological, and Pronouncing. By C. Annandale, M.A., LL.D. London: Blackie and Son.

We do not hesitate a moment to bestow upon this volume our very highest praise. It is based on Ogilvie's famous 'Imperial Dictionary,' and forms, in truth, a priceless treasury of valuable information. Every teacher should possess a copy.

The Teachers' Diary and Pocket-book for 1886. London: Jarrold and Sons.

This admirable publication has once more made its welcome appearance. Of the former issues we spoke highly, and we are pleased to be able to do the same of this. It contains, in a handy form, everything that a teacher needs.

The Eton Latin Grammar. Part I. Elementary. Compiled with the sanction of the Head Master. By A. C. Ainger, M.A., and H. G. Wintle, M.A.

An elementary Latin Grammar which is adopted at Eton as the authorised handbook, will necessarily find its way into many preparatory schools which send a large proportion of their boys to Eton, and will supersede there the use of the Public Schools Latin Primer. The goodness or badness of the Eton grammar will thus have no inconsiderable effect on the teaching of Latin in the public schools generally; and for schoolmasters the comparative merits of the primer and the new grammar will be a discussion of much interest. The excellence of its type, paper, and binding, and the absence of the overcrowded pages and small print, which make the primer so bad a book of reference for a boy at work on his Latin exercise, give the Eton grammar an obvious superiority, so far as these things go. In a much more important matter the Eton compilers have avoided a great fault of the older book. They have aimed throughout at the utmost possible avoidance of those ugly technical expressions, which, however convenient symbols for the more advanced student, are unmeaning and repellent to the beginner. The accidence, the less difficult part of the work, is well arranged, and fairly complete. But there are several omissions and inaccuracies noticeable; such as the non-recognition of *este* as a form of the second person plural imperative of *sum*, and of *forem* as a form of the imperfect subjunctive. The statement that *prece* and *obice* are commonly found only in the ablative singular is hardly to be sustained; and is it fair to treat *nolens volens* as non-existent participial forms, in the same sense as the present participle of *malo?* A stronger point might be made against the tables of genders in the third declension, and of prepositions. Whatever objections lie against the doggrel in which the primer gives the exceptions to the rule in the one case, and the list of prepositions in the other, they seem to be outweighed by the unnecessary burden put by the new grammar on the learner of remembering in each table more than a page of words without the help of any kind of *memoria technica.* One other point is worth mention. Is it not time that even elementary grammars should cease to give the name of *passive* supine to the supine in *—u.* The distinction is merely one of translation; and 'wonderful to tell' is at least as good English for '*Mirabile dictu*' as 'wonderful to be told.' The tables of verb conjugations are admirably printed and arranged. The placing of the primary tenses on a different page from the historical tenses is a good idea, and the insertion of the perfect forms in each category, as perfect proper, and past aorist, is excellent.

The second and much larger section of the grammar, which contains the syntax, falls into two parts. In the first the most necessary rules are given in the simplest possible form, with abundant examples, and a certain amount of explanations intended to meet the needs of the youngest learners. The dependent sentence is dismissed in three rules, two of which are really identical; *oratio obliqua* and conditional sentences are treated in two short and to some extent explanatory notes. The second part of the syntax contains, (1) Further details of dependent constructions in the form of a list of Latin conjunctions, etc.; (2) A list of Latin verbs, irregular in formation, or noteworthy in construction; and (3) A list of English prepositions, etc., and the way to render them in Latin. With regard to the first and last we entertain a strong objection to the alphabetical arrangement which the compilers adopted. These two lists take the place in the grammar of a more advanced syntax; and it seems to us a serious mistake, from an educational point of view, to sacrifice to ease of reference the chance of putting before the learner's eyes something of the rationale of the language on which he is at work. The fact that there are many apparent irregularities in Latin syntax is surely not sufficient reason for deliberately obscuring the existence of a substantial uniformity. The same objection applies

in some measure, to the list of verbs also. We contend that it is really better teaching to give a boy the rule, for instance, that a clause depending on a verb of asking has the purpose construction, than to provide him with a list from which he can find of *rogo precor*, etc., separately that they take *ut* with the subjunctive. One or two minor criticisms may be added. The note on the ablative absolute (p. 124) will teach a boy to avoid writing *Caesare facto dictatore mutavit leges;* but it will not prevent him from writing *Caesar visis hostibus eos adortus est.* The mistakes, of course, are not of equal importance, but a slight extension of the explanation necessary to guard against the grammatical blunder in the first example, would have pointed the learner to the normal Latin usage in the second. The explanation of the rule, 'substantives qualifying the verb like adverbs are put in the ablative,' appears likely to encourage the common schoolboy notion that 'place where' is expressed by the ablative without preposition, by classing the local ablative with the causal, etc. The true rule is given much later, under the word 'in' in the list of English prepositions. Also, should not the modal ablative be classed with that of quality, as generally used 'with epithet'? Lastly, in the examples of conditional sentences, one form, *Si peccem dolebo*, is not included; and no serviceable distinction is drawn between *Si peccem doleam*, and *Si peccarem dolerem.*

Questions on the English Language. Set at the Matriculation Examination from 1858 to 1885. By F. W. Levander.

This is not a mere reprint of the questions set during the last twenty-seven years, though such a list would have been instructive from the historical point of view. The author has arranged the questions under twelve heads; such as history of the language, phonology, etymology, and inflection, the noun, the adjective, etc., etc. The book thus supplies the teacher or student with questions on the whole course, and cannot fail to be of great service if judiciously used. Questions are real aids both to the teacher and the taught. But they may be sadly abused by both. Teachers may make the pupil understand that the end of all his effort is to write answers to questions, and a student may imagine that the best way to get acquainted with his subject is to answer questions previously set. There are some people who think this is the result of modern examinations. We believe there is some reason for the complaint so often urged; but there are a great majority of honest workers who want to learn what they can and strive to make the best use of any instruments that may be put into their hands. We cordially recommend this book to all who are so disposed.

Arithmetic. By A. G. Blake, M.A. Alex. Thom and Co., Dublin.

Of Arithmetics there seems to be no end. We naturally, therefore, look to their prefaces to see what their *raison d'être* may be, and in this particular manual the author seems to have thought that there was room for a work in which the theory was thoroughly gone into. He commences his preface as follows: 'It has been said that theory without practice is dead. Perhaps practice without theory—in the sense of blindly following a rule which we do not understand—has even less of life in it.' On looking over the table of contents, we saw that square and cube root were subjects, and the last, discussed. We knew that in no rules was there so much scope for theory and explanation, so immediately looked to see how Mr. Blake had dealt with them. It would be impossible for us to express our surprise when we found that the explanation was simply a mechanical rule, without one sentence of reason. In a short-lived, semi-comic magazine, that was published at Cambridge some few years ago, we remember a clever paper, supposed to be written by a young lady, on arithmetic, in which she gives a full description of the working of a question in long division. Excepting the profuse explanation of ticks and dots, and lines, etc., really Mr. Blake's theoretical explanation of square and cube root is very little, if at all, better.

Mr. Blake, however, gives a very sensible explanation of the unitary method of working questions, which he rightly calls that of 'common sense.' The chapter, too, on G.C.M., as far as it goes, is clear. The examples are not particularly numerous, but at the end there are 100 questions, some of which we very much doubt any student doing who had had no further help in the science than what he could have obtained in the book itself.

We were surprised to find, on page 122, so bad a mistake as the following. In reducing 17 lbs. to cwts. decimally, Mr. Blake first divides by 7, but only carries the quotient to three places of decimals; these he proceeds to divide by 4; being an exact mutiple of 4 no remainder occurs, but when he next divides by 4, after performing the operation on the three figures in the second quotient, there being a remainder 3, he carries out the third quotient to five places, writing down 75 for the fourth and fifth.

In conclusion we are bound to say that, on the whole, we are disappointed in the work; but perhaps its coming from Dublin, whence we are so glad to welcome such assistances to teachers and students as Dr. Salmon, Mr. Williamson, and others send us, led us to expect more than we have any right to, at least in a small volume of 170 pages, supposed to embrace the whole subject, from numeration to cube root.

The Definitions of Euclid. By R. Webb, M.A. George Bell and Sons.

We can well believe that this book would be invaluable to teachers, especially inexperienced ones. The number of children who plod through the first book of Euclid without really understanding what an angle is, to say nothing of a axiom, or a hypothesis, to the inexperienced is almost incredible. They accordingly learn their propositions, figure and all, by heart, and declare that they hate Euclid; or perhaps, if they learn Latin and Greek, shamelessly say they are classically inclined, and have no turn for mathematics. We have always maintained that all such declarations are due to the fault of the teachers. As long as we put our young teachers to take the classes at the bottom of the school, where real teaching power is required far more than it is in the higher forms, such complaints will continue to be heard.

The exercises given in this little book on these first ideas of form, etc., would prevent all this, and we heartily recommend it to masters, to use it as a preparation for the subject itself. At the end of the volume there is a series of easy problems in all the forty-eight propositions of Book I., from two to four or five being referred to each, in its order. The figures are beautifully drawn, and the printing is of the very highest order.

Musical Theory Course. By John Taylor. George Philip and Son.

This work is, the preface tells us, primarily designed for use by pupil-teachers and training college students, but suitable for all classes of students.

Mr. Taylor does not see any necessity for the Tonic Sol-fa, or other extraneous methods. He believes, and we agree with him, in spite of the enormous success which we must concede to the professors of the syllabic notation, that all their advantages can be combined with the old staff notation. We have always believed that the secret of the sol-fa success was, not in the notation, but in the identification of the different effects on the ear produced by the seven notes of the scale, and in the connection insisted upon between the major and its relative minor scales.

The course, or courses, are divided according to the requirements of students for different years. The first division, for instance, occupying twenty-five pages, is entirely devoted to the names and lengths of notes and rests. We notice that Mr. Taylor adopts the movable Do, and makes a good deal of the tetrachords.

In the higher course, for training colleges, we have elementary harmony treated of, and in a very intelligent and interesting way.

As an appendix there are a few—too few we fear—examination papers, and some three pages of exercises in harmony.

The book, music and all, is beautifully and clearly printed, and ought to command an extensive sale.

An Epitome of English Grammar for the Use of Students. By W. H. H. Kelke, M.A. London: Kegan Paul, Trench and Co.

The subject of English grammar, which is so often presented to the student in a dry and somewhat repellent form, is here treated with considerable freshness, breadth of view, and attractiveness. Mr. Kelke gives us very few of those formal tables and forbidding paradigms which abound in most grammar-books; but instead of this he unfolds the principles upon which our language has been built up, and illustrates, by reference to recent important researches in the science of philology, the laws of its development. Thus he shows how English has gradually changed from its early stage, which was in a high degree inflectional to its present form, which is almost entirely analytical or syntactical. The richness of our vocabulary is explained and exemplified by tracing many typical and interesting words to their respective sources in the various languages which have contributed to the making of the English tongue. Peculiar and anomalous expressions are shown to have their origin in different dialects, in the blending of different languages, in false analogies or imitations, and in the operation of natural laws of sound-change. Thus, in the second chapter of the work, Grimm's law is not only stated, but practically demonstrated by copious illustrative examples. The same chapter contains an interesting account of the formation, basis, and growth of alphabets, and a careful analysis of the sounds of the English language. We do not think, however, that any one who has made himself acquainted with the systematic and exhaustive arrangement of English vowel-sounds which partly forms the foundation of Mr. Pitman's phonetic system, will be perfectly satisfied with the results of Mr. Kelke's analysis. The diphthong *eu* in *feud*, often represented by *u* as in *tune*, seems to be lost sight of, and some of the long and short vowel-sounds appear to be wrongly paired: *o* in *fogy* is rather the lengthened form of *u* in *fun*, than of *o* in *fog*, which is the short vowel corresponding to *a* (*au*) in *fall*.

Some of the illustrations used to impress facts and principles on the mind of the student are remarkably happy and striking. Thus we have the distinction between notional and symbolical, that is, relational words, illustrated by this comparison:—'In the algebraical formula $x=m(a+b)$, we know that x, a, b may all stand for *concrete* quantities, *e.g.*, for pounds, yards, etc.; m for an *abstract* number, *i.e.*, the number of times that $(a+b)$ is to be taken; and the marks =, +, ( ) show the *connection* and *relation* between x, a, b, m. Then x, a, b may be compared with notional words; the marks =, +, ( ) with symbolical words; and m is like those words which "hover between" the two classes.'

Throughout the book stress is laid on the principle that 'the *sentence* expresses the closest relation of language to thought,' that sentences are the typical form of language, that words grow out of the analysis or breaking up of sentences, and that these words may be put together to form the same or other sentences.

In this connection occurs another apt illustration:—'In one point of view (by no means in all) this resembles analysis of chemical compounds, followed by synthetic combination into new compounds. Nature does not usually furnish us with oxygen, hydrogen, carbon, etc., in the free state; we generally have to extract them from already existing substances before we can combine them afresh; and this we mostly do by bringing together compounds under such conditions that elements of one compound become substituted for elements of another. Something like this takes place in language; as when we substitute a new verb in an old sentence, or add on an old inflection to a new stem.'

We have followed our author's expositions and reasoning with sustained interest and pleasure, but we do not feel inclined to accept all the innovations which he favours. The present accepted classification of words into seven or eight parts of speech is, no doubt, in some respects, imperfect; but we are not at present prepared for the sweeping change which Mr. Kelke advocates and foreshadows. As inflections have been dropped, and the tendency of English is towards still further loss of inflections, order and relation have become more and more the governing factors in the correct use of words in sentences. Both the chief parts of grammar, accidence and syntax, are greatly modified by this change—the former loses and the latter gains in importance; but it is still possible to classify words according to their function, and, as we hold, it is still important that grammar should take note of the relations expressed no longer by inflection, but by position and the increased use of symbolical words. We think much may be said for retaining a separate classification for adjectives instead of regarding them as secondary nouns; and in parsing it seems to us important to note the *case* or relationship of nouns, even though those changes of form in which the name originated have, for the most part, ceased to be the marks of distinction.

We have ventured to express some dissent from the conclusions of Mr. Kelke, who seems to be in advance of most modern writers on English grammar. But though he does seem here and there to treat received notions somewhat cavalierly, he is no dogmatist, and will pardon those who realise his anticipation that 'his treatment of adjectives, and still more its corollary in the abolition of adjective sentences, may perhaps prove a stone of stumbling to some.' For, on the question of classifying words, he says: 'The exact classification we adopt is never the only one possible. Words, whether we consider them in general, or as they stand in a particular sentence, are versatile and many-sided; in classifying we cannot present all the sides at once to view. Words are not like chemicals, which can be tested, and then arranged in bottles on a shelf, labelled once for all, and kept ready for use.' And, speaking of objectionable forms of leading questions in examination papers, he protests against 'the dogmatism which thus fetters the unhappy candidate in his answers on moot points, forbidding, as it were, free thought and free discussion.'

The book, as a whole, will prove very useful to those for whom it is specially intended—namely, students preparing for matriculation and other similar examinations. The chapters on syntax will be very helpful in dealing properly with those examples of doubtful English, which the student often finds much difficulty in 'correcting or justifying.' Many of these are very fully treated of. The last chapter gives a concise account of English prosody. One appendix affords examples of English in different stages and styles, and another consists of several examination papers set for matriculation in the University of London.

We cannot forbear adding one more quotation from the comments appended to two extracts from Gibbon and Freeman:—'The difference between the styles is indeed far from being a difference merely in relative amount of Saxon or classical words; it is a difference of *flavour*. Gibbon's style may remind us of old Port; Freeman's of dry Champagne. Either style, in the hands of a master, has its merits; either may be overdone.'

Pictorial Alphabet. London: Jarrold and Sons.

This wall-plate will be hailed with delight by all the little folks in infant schools and private families who are still struggling through the mysteries of the English alphabet. Without exhibiting anything extremely incongruous in relation to its surroundings, the picture contrives to furnish examples of numerous objects whose names commence with the various letters of the alphabet. A zigzag path leading up to a windmill on a distant hill

deals most satisfactorily with that awkward letter Z; and the other letters are managed equally well. We feel sure that the use of this little wall-sheet will give most encouraging results, not only in the actual teaching of the forms and sounds of our letters, but also in increasing the interest which the little ones will take in their alphabet lessons.

Longmans' New Readers. First and Second Primers. Infant Reader. Standards I., II., and III. London: Longmans, Green, and Co., 1885.

In this new series the Primers contain a systematic means of teaching the elements of reading by a combination of the alphabetic and look-and-say methods. In the First the words used are almost entirely those short words which are regularly spelt and which exemplify the short vowels; in the Second are introduced the regularly-spelt words containing the long vowels. Lists of words rhyming to both ear and eye are largely used to impress on the learner's mind the value of the letters, and so to lay the foundations of spelling. Likeness, contrast, repetition, boldness of type, are all used as devices to make the early impressions clear and lasting. The same combination of methods is continued in the Infant Reader, in which the lists of words illustrate the diphthongs and more difficult combinations of letters used in common words. The lessons are very simple in construction, of a nature to interest very young children, and well within the comprehension of those who can be taught to read monosyllables. The illustrations are numerous, and superior to most of those we have met with in books for teaching reading to young children. We do not remember any books in which so many aids have been effectively used to secure the important object of teaching the first rudiments of reading.

In the books for the Standards we are first struck by the bold and clear type, the firm and smooth paper, the abundant and beautiful illustrations. Many of these are full-page, and are really gems of wood-engraving. The lessons seem, for the most part, to have been especially written for the series. They are, therefore, just adapted to the ordinary capacity of the children for whom they are intended, and at the same time they have the merit of being fresh and interesting. The language and construction, without being particularly childish, are such as can be understood by, or easily explained to, children. The subjects chosen, too, are likely to prove interesting to children, and to have a good moral tendency. They consist of descriptions and anecdotes of common domestic animals, stories of children, fables, and simple poems, with occasional dialogues. In the book for Standard III. are lessons on the hawk, eagle, ostrich, elephant, sheep-dog, beaver, wasps, some fairy tales and fables, and an interesting story, 'The Four MacNicols,' by William Black, in six short chapters. In all the books, the plan of singling out the more difficult words, and forming them into lists as spelling lessons, is largely adopted; and in these lists the editor has not hesitated to include over and over again any words which present special difficulty. In the earlier books some of the lists are in script, white on black ground, for copying on slates. In Standard I. we notice the word *alright*. The words *always*, *also*, *already*, *almighty*, would certainly suggest the spelling here given, but we do not remember having seen the combination in print before.

Short and simple explanatory notes are appended to most of the poems, and many exercises in grammar and word-building, as an aid to spelling, are inserted. We do not know why two lines are omitted from Lord Houghton's pretty poem, 'Good Night and Good Morning.'

All the books are issued in crown octavo, and are strongly bound in rather handsome crimson covers; the primers are issued in paper covers also.

We have been glad to speak so highly of this series; but we have done so after careful examination and thorough reading. We trust the rest of the series may be equal to this beginning.

Children's First Verse Book; for Reading and Recitation. By J. S. Laurie. Simpkin and Co.

This is one of the earliest volumes of the 'Children's Library,' edited by J. S. Laurie, formerly one of H.M. Inspectors of Schools. It is a collection of about sixty pieces of verse, or, as the editor calls them, 'sense-verses,' not, as a rule, pretending to the qualities of poetry, but filling a gap between nursery rhymes and poetry proper. The book is very suitable for young children, as treating in a pleasant and playful way of matters in which they feel interest. Some of the pieces, as the 'Baby Doll,' by Kingsley, 'Temptation,' by Allingham, and 'Good Night and Good Morning,' have the true ring of lyric poetry, while they are quite within the range of the childish understanding.

Double Entry Book-keeping. By Andrew Sarll, A.K.C. George Gill and Sons.

We have always maintained that the amount of practical book-keeping a student can learn out of a counting-house is very small; but, since it is now a subject of examination, we cannot but welcome so valuable a work as the one under review.

Mr. Sarll is an experienced teacher of the subject, and thoroughly understands how to express what he wants to convey. Almost the only thing the student can learn theoretically is the difference between debtor and creditor, which is by no means as easy as may at first sight appear, especially in the intermediate stage of journalising: *e.g.*—supposing a man accepts a bill which he is unable to meet, a good many entries have to be made, which may well puzzle the uninitiated. We have mentioned this example, as we were particularly struck with the lucid way in which Mr. Sarll explained such a transaction from beginning to end. In addition to numerous examples, there are some thirty pages of actual examination papers, as set by the College of Preceptors, the Civil Service Commissioners, Society of Arts, and City of London College, which we cannot but commend as an admirable feature. To the copy sent in there is a key attached, but an edition is published at half-price without it. Most of the key is printed in script, that the student may realise exactly what his work ought to look like. This, we think, is a good idea; in other respects, too, the book is beautifully printed and strongly bound, and we heartily recommend it as the best and cheapest manual on the subject we have ever seen.

An Elementary Treatise on Book-keeping by Double Entry. By David Tolmie. Blackie and Son.

Mr. Tolmie, in preparing this work for those reading for an examination, evidently has brought, and with considerable success, a great deal of experience to bear.

The first principles, which are so important to be thoroughly grasped from the very beginning, are well explained. The exercises are ample, to which a key has been published, but of this we cannot speak, as a copy has not reached us.

The rules for journalising are well and simply expressed. An entire chapter is devoted to 'bills,' and a clear account is given of them from their first drawing until they have been fully paid.

At the end of the little volume there are some concise methods of calculation, which are given without reasons. As book-keeping is, perhaps, rather an instructive than an educational subject, we suppose we must not find fault with them; but would not a few lines of explanation as to the why, etc., satisfy the more intelligent student, who dislikes doing what he cannot understand? Here is an example: To find the interest at 5 per cent. for days, multiply the principal by $\frac{1}{2}$ of the days; cut off the unit figure of the £ from that product; consider those not cut off as pence; deduct a penny for each 6s. contained therein, and the remainder will be the answer. Let us try and see where this rule comes from. Accurately call-

ing the principal P, and the days t, the interest would be $\frac{P\times 5\times t}{365\times 100}$. Now, if for 365 we write 360, the formula becomes $\frac{P\times 5\times t}{360\times 100}$, which may be reduced to $\frac{P\times 5\times t}{120\times 2\times 5\times 10\times 3}$, or $\frac{P\times \frac{t}{3}}{240\times 10}$, whence the first part of our rule. Now, the difference between $\frac{1}{360}$ and $\frac{1}{363}$ is $\frac{1}{7\cdot 9}$, or very nearly $\frac{1}{7\cdot 9}$, which, of course, is 1d. for 6s. We cannot help thinking that such explanations would materially improve this part of the book, especially as we very much doubt whether all, or even a fair proportion of, teachers would be able, if asked, to give such an explanation.

The book is beautifully printed, and worthy in all ways of the house that issues it.

An Introduction to the Differential and Integral Calculus. With Examples of Application to Mechanical Problems. By W. J. Millar, C.E. Pp. 63. London: Blackie and Son; 1885.

Mr. Millar's idea is a very happy one, and to a certain, but much more limited extent, praise may be awarded to him for his execution of the same. It always has been impossible as yet, and in all probability it always will be equally so, for any one to attain any knowledge that is worth having, of either physical or mechanical sciences, without serving a lengthened apprenticeship to pure mathematics, and in particular to that master of them all, the Differential and Integral Calculus. Various authors have tried to avoid this necessity, but with only limited success. Professor J. Clerk Maxwell, for instance, in his *Theory of Heat*, deduces the greater part of the most recondite results of Thermodynamics without appeal to anything beyond the simplest geometry, but it may be roundly asserted of this, as of every other book of the kind, that the simplifications have made it so difficult that it takes a professed mathematician to understand it.

There is certainly, then, room in our educational literature for a book which, without being inaccurate, should be a short and pithy introduction to the main features of this the most beautiful of all the mathematical sciences. Mr. Millar has endeavoured to do this, his special aim being the enlightenment of engineering students. We have one or two faults to find. In the first place he is not quite as accurate as we could wish. When, for instance, he is considering, geometrically, on p. 6, the increment received by x^2 as x receives an increment h, i.e., $2xh+h^2$, and argues thus:—'It will appear at once that the smaller the increase h is made, the smaller will the part represented by h^2 become; and if we assume that the increase (h) of the side (x) is infinitely small, the part represented by the square of this increase may be neglected"—we cannot but feel that he is using a very vicious style of argument, the whole question being, not at all whether h^2 is infinitely small, but whether it is infinitely small *compared to the quantities retained.* We allow, of course, that this is a mere slip, but it is one which is of grave importance in a book where the notation of differentials is used in preference to that of differential co-efficients. Here again we differ greatly from our author. For certain purposes, especially in the Integral Calculus (such as the change of variable), the notation of differentials has immense advantages over its rival; but it is before all things necessary for the student to constantly keep the meaning of the symbols before him, and the difficulty of doing this (especially when we come to second and higher differentials) is infinitely augmented by the notation in question.

The usefulness of the book could, we think, have been greatly increased had more care been taken with its arrangement. Articles 1—8 explain the meaning of the terms involved, and give the rules for differentiating powers, products, and fractions. Then in Articles 10—11 we meet with "Examples of Application to Practice." But surely the theory of Maxima and Minima should have more importance assigned it than is given to a mere exampl (Article 11). Then we come to the Theory of Integration, and are told how to integrate powers (Article 12), applications given being the calculation of the torsional strength of hollow cylinders, the moments of inertia of fly-wheels, the pressure of water against lock-gates, the strength of beams and the areas of certain surfaces. Article 18 contains a very unsatisfactory investigation of the area of a circle, which ought really to have been deferred to the conclusion of Article 23, where it would have followed as an easy corollary from the values there found for the integrals of the trigonometrical ratios, which, with the further addition of the integral of the reciprocal of the variable, complete all that Mr. Millar tells us about the Calculus. The other examples, given at various parts of the book, are the finding of sundry areas and volumes (or as Mr. Millar chooses to call them alternatively, 'Solidities'), and centres of gravity; Guldinus' Theorem being quoted at the top of p. 54, but never, so far as we have found, either mentioned by name or explained, much less proved.

But we object to Mr. Millar's omissions more than to anything we have mentioned as yet. For example, so far as we can find, he never even states that dy/dx represents the tangent of the angle which the tangent to the locus of y makes with the line x; and surely he will allow that a student is expected to understand this when he comes to the perusal of Rankine's works, or those of any other master of the science, for it is quite impossible to grasp the theory of Isothermals, to which a passing reference is made in Article 21, without a knowledge of it.

If we had not already exceeded our limits we could point to several other omissions sufficient, as we think, to condemn the book. We are sorry to have to say this, for we repeat that, to our thinking, there is no book so urgently needed as that which Mr. Millar has endeavoured, we fear unsuccessfully, to supply.

Wesleyan Methodist Sunday School Union.

Our Boys and Girls.

We have here the twelve monthly parts of this halfpenny magazine, bound together in an attractive cover, with a pretty picture in colours on the outside. The serial is well illustrated, and the letterpress is quite up to, if not above, the average of such magazines. Though the price of this work is only a halfpenny a month, it must not, on that account, be considered as only suitable for very young children.

It seems almost a pity that some serial story is not given, as we feel sure such would increase the sale of the publication.

There are Bible lessons and questions, as well as puzzles of the usual type. Though published by a particular branch of Protestant Christendom, we may assure our readers of other denominations that they need not fear, on that account, to put it into their children's hands.

We now turn to the Prize Books, which, we may mention, are prettily and strongly bound, and well printed on good paper.

Eleanor's Ambition. By Sarson C. J. Ingham.

We cannot help believing and hoping that this unpretending little story may do a great deal of good. The heroine is introduced as injuring her health in preparing for a Cambridge examination. She accidentally hears her mother and elder sister, who is going to be married at the end of some few months, speak of her uselessness in the house. This, with other circumstances, prepares her to receive kindly a suggestion of her sister's, to learn from her some domestic duties to enable her to be of use, and take her sister's place when she has gone to her own home. This arrangement is carried out with great success. Two other characters of a studious nature figure in the book, the one doing well in her examinations, the

secret of which is explained, and the other breaking down altogether.

The moral is just what is wanted in the present race for honours so many young ladies have entered upon. Selfishness and an unworthy ambition the author evidently thinks have much more to do with the efforts of these young students than many of them suppose.

Though published by the Wesleyan Methodist Sunday School Union, not one word of sectarianism has found its way into the book, the religious instruction even, which is healthily evangelical, is supposed to be given by the Rector of the parish, and all the characters that appear are members of the National Church.

The Archer's Chance Shot. By the same Author.

Though Mr. Ingham, if he be a member of the Wesleyan body, is evidently, as proved by the book of his we have just noticed, very liberally disposed towards other Protestant Christians, we cannot say he holds out the same hand of good-fellowship towards the members of the Church of Rome. The first chapter is headed 'Friends in Spite of Rome.' We were not, therefore, surprised to find that the friends were of different religions, and that the 'chance shot' had something to do with the con- or perversion of one of these friends. Whether this kind of book does any good we will not venture to say, but Mr. Ingham brings a good deal of power to bear in treating of the subject, and produces a decidedly interesting story. The daughters of the two friends are as charming as they are artistically drawn, and let us hope that his priest and two sisters of charity are not typical.

Waiting: An Allegorical Story. By same Author.

Mr. Ingham strikes out a new line for himself in this allegory, with the evident intention of teaching the doctrine of special guardian angels. He begins his story with the following:—'Every time a new little lamp of existence is lit upon earth God chooses one of His angels to come down and witness it, and He gives that angel charge concerning it, telling him that he must keep watch over the child all his journey through.' . . . How far this, in detail, may be in exact accordance with the authoritative teaching of the Primitive Church, or even of the body of Christians who issue this little volume, we will not say. It is a wholesome doctrine, even the individual angel to the individual child, and one that will do no one anything but good to believe in.

The little child whose angel-watched career is given here arrives in this world just as her mother leaves it, the two angels meeting on their respective ways. She is born to affluent circumstances, being the daughter and heiress of a wealthy baron. The angel, whose name is Theophile, receives from his Master's hand the scroll of the child's destiny, on which he finds written the word 'Waiting.' This, then, was to be her fate, and in waiting is her character developed and perfected, until at last we find her waiting for her final call 'home.'

Though called an allegory, there is nothing mysterious in this story, which is of this world, and this world only, excepting the realisation of the constant presence and help of her particular guardian angel.

We heartily recommend the story as pretty and useful

Senior Scholars' Tablet Book.

This is a little threepenny book, consisting of as many pages as there are Sundays in the year. On the one side there is a pretty little picture, giving some scene from one of the Bible lessons mentioned beneath. Then there is some well-known text printed in full, and one verse of a hymn, together with two or more questions and answers from the Second Catechism. On the back of the page there are three questions (some of which are subdivided), with space left under each question, for a manuscript answer to be supplied by the pupil. As a place is left for the name and class at the top of each page, we suppose that these sheets are supposed to be torn out and given up to the teacher.

A written lesson, however poorly done, necessitates some effort, at any rate, on the part of the scholar, and on that account, if for no other, we think the idea is a good one. The paper is not quite good enough to give a perfectly clear surface for writing, the printing on the other side being more or less visible. A very slight increase in the expense of producing, would remedy this: and this really ought not to raise its selling price, which is certainly high enough, considering the sale for such a work the Connection would command. In other respects we recommend it heartily.

Junior Scholars' Tablet Book.

This is precisely a similar work for younger children, in which the lessons and the questions are easier. The hymn is more simple, and the questions and answers are those found in the First Catechism.

The Acme Drawing Cards. First Grade Freehand, Sets E and F. By James Wadey. London: Thomas Murby, 3, Ludgate Circus Buildings.

Set A of the same series of Drawing Cards was noticed in the November issue of this magazine. The cards in these sets are a little broader, and the examples slightly larger, than in set A. They are not, however, as large as the New Drawing Syllabus asks for. The learner must therefore practise drawing to a larger scale, as he builds up his drawing, when using these cards. The copies are difficult enough for the fourth, fifth, and sixth stages of the new class subject. The fact that the author has taught drawing with great success will be a strong inducement to others to try his methods. The cards are good.

The History of the Reign of George II. By Oxon. London: Swan Sonnenschein, Le Bas and Lowrey, Paternoster Square.

The age of competitive examinations has brought forth considerable fruit in the great crop of cram books now published. For any examination for which the reign of George II. was the prescribed period of history to be prepared, it would be difficult to find a better analysis than the one under review. It is an analysis based on the best authorities, principally Bright, Green, Macaulay, and Chambers. It is, however, only the 'dry bones' of the subject, and wants the life to be found in the glowing pages of the above historians. We are of opinion that for the purposes of real education and study, it is the duty of the student to make such an analysis for himself. Once done by him, he cannot but have a better idea and a firmer grasp of his subject than by committing to memory an analysis already made. But, granted that such a book is to be used, then we have little but praise to give to 'Oxon's' work. The policy and the characters of the chief statesmen of the reign are very clearly delineated, and the causes of their successes or failures intimated with exactness and impartiality. The entangled diplomacy, treaties, and engagements of the time are unravelled, and a clear and definite statement of battles and their results plainly set forth. The language used is terse and incisive, but however expressive some of the sentences may be, we think that even in an analysis all loose terms and slang expressions might have been avoided.

Eighty original and selected questions on the period, and a lengthy and carefully prepared index, add considerably to the value of the book, which is printed and published in an excellent manner.

Modern Geographical Names. By Geo. Chisholm, M.A., B.Sc. London and Edinburgh: Blackie and Son.

A most useful book. Teachers of geography need not rest in uncertainty as to the pronunciation of foreign names. By repeated tests we have found this little book a safe guide, and shall make it a constant friend.

Fifty Examination Papers in Dictation and Grammar. Compiled by a Head Master. London and Manchester: John Heywood.

A teacher may here find ready prepared to his hand examinations in these two subjects for all the standards from I. to VII. The selection has been made from contributions received from every part of the country, and from most of the popular series of reading books. There is thus considerable variety, and a possibility of being prepared for any inspector, if these or similar tests can be fairly answered without difficulty. The book is well printed, neatly bound, and reasonable in price.

Royal Story Book of English History. London and Edinburgh: T. Nelson and Sons.

The first edition of this book is well known, and this enlarged edition will be equally popular with its predecessor. It is written, printed, illustrated, and published in all points on a par with the other publications of this well-known firm, and is very suitable for the standard for which it has been compiled. All the accessories of a good reading book are to be found in its pages.

Chambers's Geographical Reader. Standard VI. London and Edinburgh: W. and R. Chambers.

We have previously had to speak in terms of praise of this series of Geographical Readers, and the one under notice follows close on the heels of its predecessors for quality and suitability. The various countries are described without loading the text with names; maps are frequently interspersed, and a good summary of the chapters added at the end of the book. The illustrations are but few, and those not of a high quality. As a whole, however, the book will take its place among the most suitable for the class subject Geography in Standard VI.

Livy. Book XXI. Edited, with Introduction, Notes and Maps, by the Rev. L. D. Dowdall, M.A. Cambridge: Deighton, Bell, and Co.

This is a very different work from the last in every way, being intended for a very different class of students. It is a most scholarly treatise on the well-known portion of the great history, the introduction, as well as the notes, being full of most valuable information, and showing very considerable learning of all kinds. We heartily commend it for those preparing for any higher examination of which it is a prescribed subject. The maps are clear and useful, being especially designed to illustrate the topography of the subject.

A Digest of English History, 1760—1815. By M. Gutteridge, B.A. London: Relfe Brothers.

This book is principally designed for the use of candidates for the Oxford and Cambridge Local Examinations—those mighty levers in modern curricula and text-books for all schools, excepting those of the very first class. For candidates who do not take in Latin or Greek, history and geography no doubt will enable them to improve their position in the class lists; but we believe with the higher class of candidates these subjects are not at all popular, as requiring more time than they are worth from a 'mark' point of view. Originally—if we remember rightly—these subjects were compulsory, but the Syndicate being petitioned by some schoolmaster, they were made optional. To such as do take up the subject, this work ought to be invaluable, not of course by itself, but as a reminder and arranger of what they have read and learnt elsewhere.

Its great want is, to our minds, an index, which we should hope the author would add ere he brings out another edition.

The genealogical tables are clear, not being overburdened with names. The book might also be improved with a rough map or two containing the places where battles, etc., took place. We, nevertheless, heartily recommend it.

A First Course of Physical Laboratory Practice. By A. M. Worthington, M.A. Rivingtons.

This work of about three hundred pages is intended to supersede a little volume of fifty pages published in 1881. The original book, we are sure, was a welcome aid to many teachers, who had already felt the need of something beyond mere lectures. The author took pains to show that, while measurement was necessary in order to make physics of educational value, the measurements need not be more than approximate. Measurements by 'costly instruments requiring on an average two hours for each experiment' are out of the question.

We believe that the attempt made in 1881 in the little volume before noticed was a useful and successful one. We are, therefore, heartily glad that Mr. Worthington has developed his ideas and greatly enlarged his book. It supplies now nearly all that can be expected to be done in middle-class schools and science classes. We can cordially recommend the use of the book to pupils for the May Science Examinations. We have found again and again that students who have made a few determinations for themselves get a much more intelligent grasp of their subject afterwards, even with regard to points they may not have come to verify. Actual work seems the best cure for the nonsense that ordinary pupils talk when they give instructions for performing experiments.

The book before us consists of nine parts. Part I. deals with mensuration (of a practical kind); Part II., with hydrostatics; Part III., with the barometer; Part IV., with mechanics; Part V., with elasticity; Part VI., with heat; Part VII., with magnetism; Part VIII., with statical electricity: Part IX., with current electricity.

We feel sure that if teachers could see some parts of this book they would set some of their pupils at work with it at once. We give a few quotations:—

To find the area of the cross section of a thin wire.

INSTRUCTIONS.—Take a piece of fine copper wire five or six metres long, wrap it into a small coil, and hang it from the short pan and counterpoise. Find the loss of weight in water in grams. This gives the volume in cubic centimetres, and since volume = area of cross section × length

$$\therefore \text{Area of cross section} = \frac{\text{volume}}{\text{length}},$$

It will be observed that there is no reference here to the temperature of the water or the pressure of the air. And with beginners there should be none. If the pupils develop a capacity for physics, they will find afterwards the instruction they need in works like Kohlrausch, Glazebrook, and Stewart.

We conclude with a second experiment, which is only a fair specimen of the rest, but has the advantage of being short.

To find the density of a saturated solution of methylated spirit and of common salt, by floating a pencil first in water, then in the liquids in question.

INSTRUCTIONS.—Argue on the following example:—

The pencil floats in water with (m) cms. submerged;
" " in the solution with (n) cms. submerged;
∴ Weight of a rod of water (m) cms. long = weight of pencil;
and ∴ " " of solution (n) cms. long = weight of pencil.
∴ Weight of a rod of water (m) cms. long = weight of a rod of the solution (n) cms. long.
∴ The solution is denser than water in the ratio $m : n$.
∴ Density of solution is $\frac{m}{n}$.

N.B.—Instead of a pencil, which is troublesome to hold, you can use a glass tube, stopped at the bottom with wax, and weighted with shot or mercury. The depth of immersion may be noted on a paper scale placed inside the tube.

We hope the book may have a wide circulation, both among teachers and pupils.

Elements of Physiography. By John J. Prince. Manchester: John Heywood.

Full of matter and reliable. We have tested this book by the questions set by Professor Judd and Mr. Lockyer in their examinations held this week, and it has not been found wanting. The demand for this, the sixth edition, is evidence of the esteem in which students hold these lessons. The book lacks one thing, and that a most important feature for the private student—it is wanting in pictorial and diagrammatic illustration.

Object Teaching for Infant Schools. By W. Taylor. Westminster: National Society's Depository.

Infant teachers will hail this book as a fresh delight. The thorough sympathy with child-mind which it manifests on every page; the complete accord with the principles of early mental growth displayed in the arrangement and illustration of every lesson; the logical sequence observed in the grouping of lessons, all combine to make this a necessary possession of every infant teacher.

Philips' First School Atlas. London and Liverpool: George Philip and Son.

The novel and very commendable feature in this Atlas is the series of questions which are made to face each map. The questions are carefully selected and well framed. This Atlas will heighten the interest in geography wherever used.

Practical Hints on Infant School Work. Practical Hints on Elementary School Work. By an Experienced Examiner. London and Liverpool: George Philip and Son.

It is well that teachers, like other men, should sometimes see themselves as others see them. An experienced Examiner points out defects and suggests improvements in our methods of teaching. His aim throughout is to make the schools which come under his influence 'excellent.' The advice given in these handbooks, if followed, is calculated to secure this much-coveted distinction.

Geographical Readers, Animal Life on the Globe. By Geo. Chisholm. London: Longmans, Green, and Co.

Children delight to be in contact with life in all its varied forms. 'Tales of hunting and fishing, of sea-travel, of struggles against dangers, of customs and manners, of traditions and migrations, are obviously among the best means of developing in a child the desire of studying nature.' Mr. Chisholm has in large part worked out Kroptokin's idea of what geography ought to be in the early stages of child life.

The Seasons Pictured. By Richard A. Proctor. London: Longmans, Green, and Co.

Mr. Proctor is a charming exponent of realms beyond our own. Those who wish to realise by the aid of exquisitely-drawn diagrams, the various positions occupied by our earth in its journey round the sun, as well as the appearance of the constellations forming the zodiacal belt, should do so by the aid of Mr. Proctor's sun-views of the earth and his zodiacal maps.

We learn, upon the best authority, that the Needlework Manuals of Miss Emily G. Jones, Directress of Needlework to the Education Department, have recently become the property of Messrs. Longmans and Co., by whom they will in future be published. As Miss Jones's books are now the recognised standard works on Needlework and Cutting-out, we strongly advise our readers to adopt the series.

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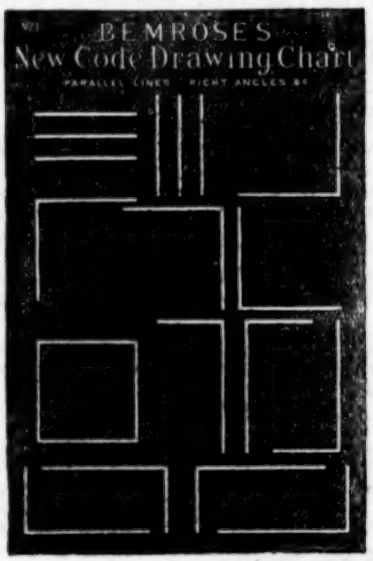

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